THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIII. No. 1358.] LONDON, MAY 21, 1889. [41ST YEAR. Price 6d.

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Improved Continuous Distillation. Extracts all Ammonia.
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This Apparatus has been successfully at work for years in over 100 Establishments in England, Germany, France, and America.

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Manufacturers of

IMPROVED CONSUMER'S WET GAS-METERS

IN CAST-IRON CASES,

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AND

IMPROVED DRY GAS-METERS;

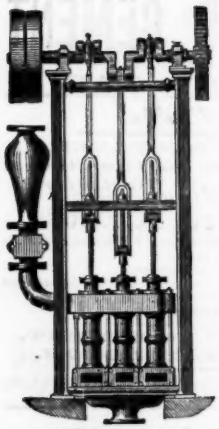
STATION METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

STEAM & HAND PUMPS FOR GAS-WORKS.

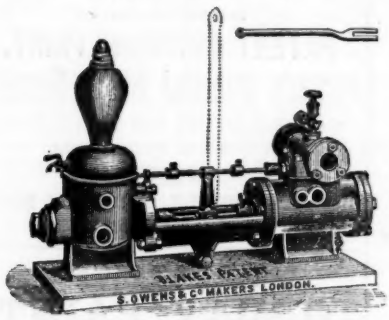
FOR PUMPING TAR, WATER, AND LIQUOR.



Treble-Barrel Pumps in Frame.

Syphon Pump.

Double-Barrel Force-Pump in Frame.



BLAKE'S
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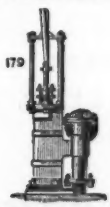

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CENTRE VALVES
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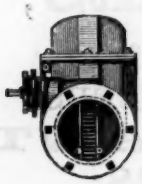
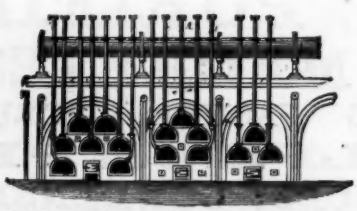
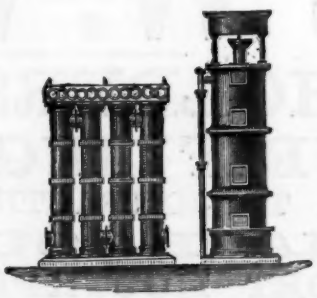
Also Bye-Pass & Stop Valves.







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HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS.

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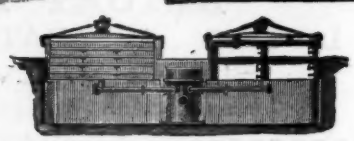

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Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

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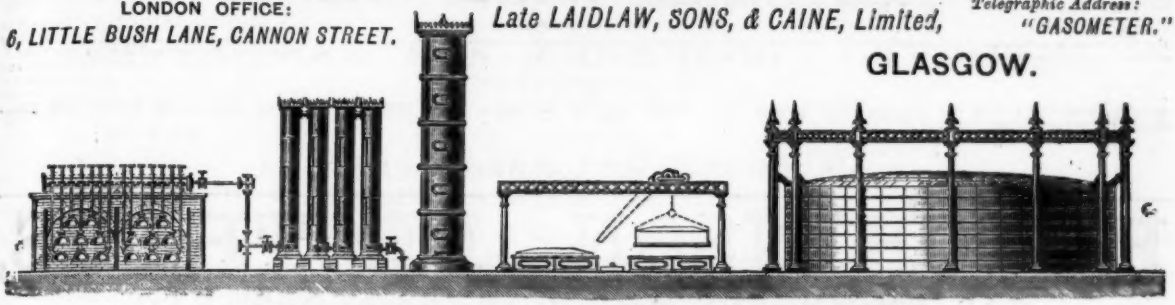

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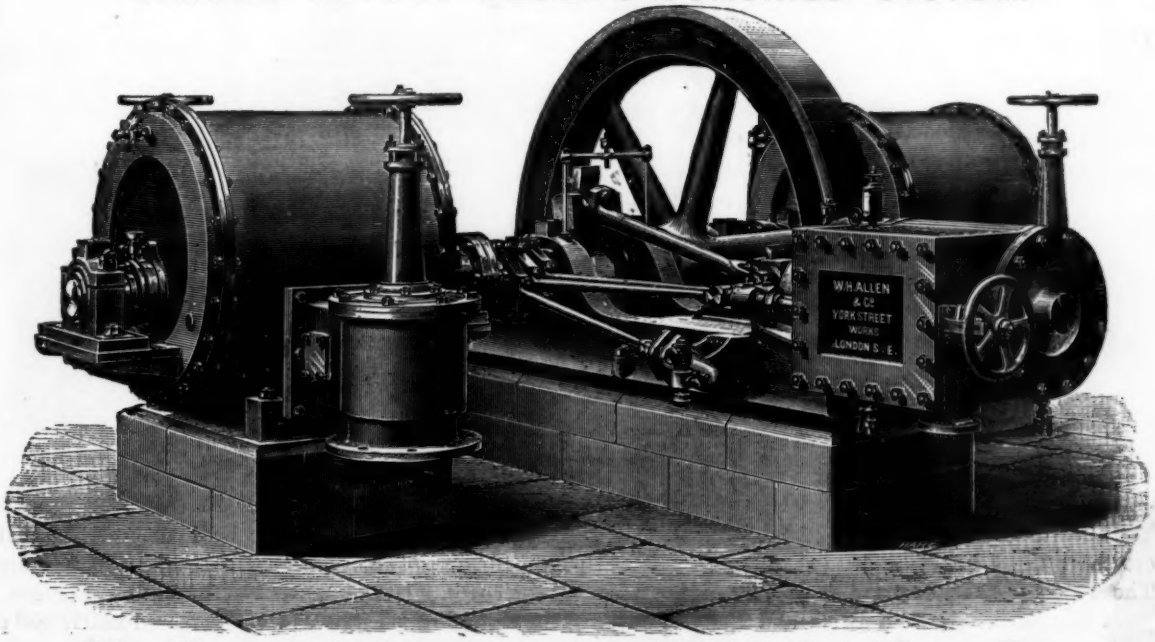
MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.



Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

SPENT LIMES NO LONGER WASTE PRODUCTS!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

MOST EFFECTIVELY AND *ECONOMICALLY RESTORES* LIME WASTES CONTINUOUSLY.

The Patentee having under his several Patents effected a complete solution of the Spent Lime difficulty, most confidently solicits the consideration of the fact by the Engineers and Managers of Gas Companies, Gas Corporations, and other SpentLime producers. The adoption of these Patents secures the following amongst other advantages, viz.:—1st. Nuisance is avoided, and the utmost convenience and comfort in Gas purification are secured. 2nd. The Lime is recovered at from one-third to one-half the cost of new Lime, or from 5s. 6d. to 7s. 6d. per Ton (depending on extent of works and working charges). 3rd. The Lime is either recovered for Building and Agricultural purposes, or specially and continuously for Gas purification—no limit being assigned to its durability. 4th. Nearly the whole of the valuable sulphur is collected and sold. 5th. By the Patentee's Improved Furnace, breeze or inferior cannel coke only is required as a fuel. The process has been worked for a considerable time by several important Gas Companies and Corporations throughout the Kingdom, and with the most satisfactory results. The Patentee erects, proves, and grants working on very moderate terms.

Further particulars may be had on application to A. F. Wilson, Esq., Assoc. M. Inst. C.E., 12, Walbrook, London, E.C., Agent for London; J. E. Fisher, Esq., Stourbridge, Agent for the rest of England, Wales, and Ireland; or to the Patentee—

GEO. R. HISLOP, Engineer, GAS-WORKS, PAISLEY, N.B.

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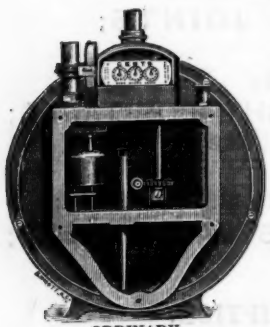
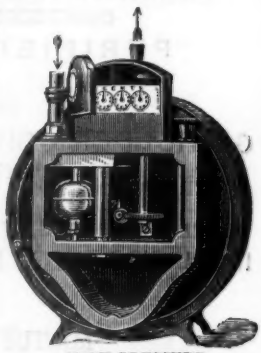


ORDINARY.



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GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

Illustration showing view of two Telescope Gasholders, each 65 feet diameter by 48 feet high, recently erected by Messrs. R. and J. Dempster, in Tanks previously occupied by Single-lift Holders 20 feet deep. The Tanks were made 4 feet deeper, by adding a Tier of Cast-Iron Plates, prepared with suitable Flanges, to meet the Brickwork of a Brick and Puddle Tank. The storeage capacity was thus increased nearly 150 per cent. at comparatively little outlay.

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THE MOST STANDARD IS

HARCOURT'S "PENTANE"

NO. 2.

AS USED BY

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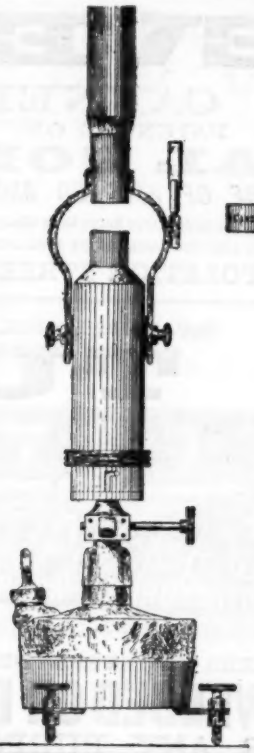
E. S. COMPANY OF GREAT BRITAIN, Ld.,

11, QUEEN VICTORIA ST., LONDON, E.C.



RELIABLE STANDARD OF LIGHT IS

STANDARD LAMP.

IMPROVED TYPE.

AS USED BY

Dublin University.
Harvard University.
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MANUFACTURERS OF WROUGHT-IRON TUBES AND FITTINGS, BRASS GAS-FITTINGS, GAS-VALVES, STEAM AND WATER VALVES, &c.,
And of WARNER'S PATENT MARKET GAS STAND-PIPE.

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THE "DIFFERENTIAL" POSITIVE WATER-METER

COMBINES THE

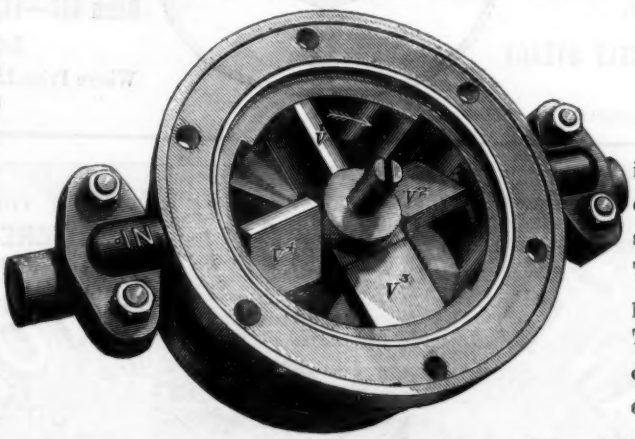
ADVANTAGES OF INFERENTIAL & POSITIVE METERS

IN USE AT HOME AND ABROAD FOR DOMESTIC AND TRADE SUPPLY.

Working Parts of Gun-Metal and Ebonite.

Explanation.

The opposite Vanes are fixed rigidly at right angles upon the same Spindle. In moving they have a feathering motion, and when on edge pass through a contracted Chamber. The pressure of Water thus acting on the edge of one Vane and the face of the other, causes a noiseless uniform rotation.



DURABLE.
ACCURATE.
COMPACT.

The water is measured as it passes direct through an enlarged area. There is consequently no loss of head. The Meter has no valves, ports, pistons, or gearing. There is therefore no periodical attention, oiling, packing, or adjustment required.

[For further particulars, see last week's "Journal," p. 917.]

THE LONDON WATER-METER COMPANY, LTD.

Offices: 2, CHANCERY LANE, E.C. Works: GRAY'S INN ROAD, W.C.

LONDON.

G. J. EVESON,

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A SPECIAL COMPOUND

FOR THE CURE OF STOPPED ASCENSION-PIPES,

A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power.

PRICE AND PARTICULARS ON APPLICATION.

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ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

The Schülke Regenerative Lamp

FOR

DOMESTIC AND EXTERNAL LIGHTING.

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

A PURE WHITE & PERFECTLY STEADY LIGHT,

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

SCHÜLKE GAS-LAMP Co.

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Where Price Lists and full particulars may be obtained.

Price Lists AND **Full Particulars** On Application to

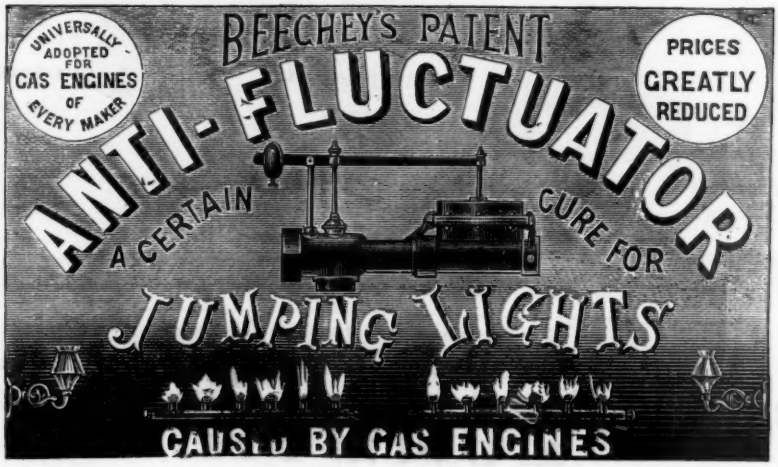
W. PARKINSON & CO.,

Gas Engineers,

Cottage Lane Works,

CITY ROAD,

LONDON, E.C.



Price Lists AND **Full particulars** On application to

W. PARKINSON & CO.,

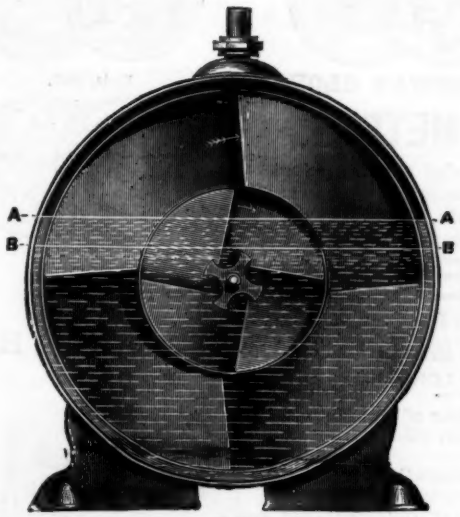
Gas Engineers,

Cottage Lane Works,

CITY ROAD,

LONDON, E.C.

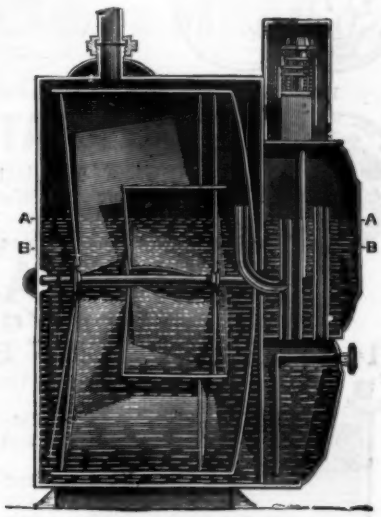
THE WARNER AND COWAN METER.



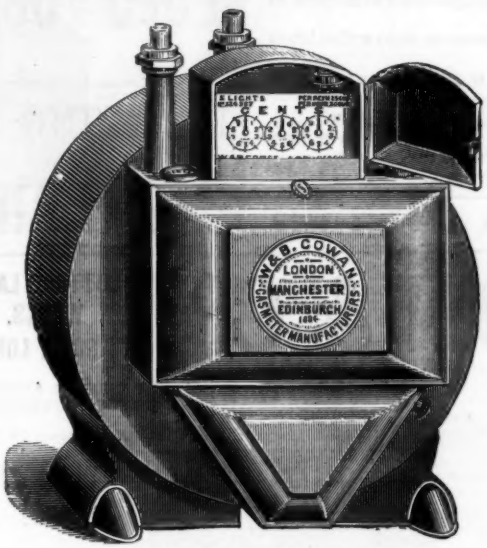
A A, High-Water Line.

B B, Low-Water Line.

Drum in Case. Hollow Cover removed.



Sectional Side View of Meter.



Elevation showing Tin Case Meter.

Elevation showing Cast-Iron Case Meter.

In its completeness as a measure, the WARNER AND COWAN drum differs from every other. Of definite capacity, irrespective of the water-line, it can neither be over nor under filled, but discharges at each revolution the same volume of gas.

It is to this also that its secondary, though important, advantage is due—viz., the long float-range which this drum permits.

The illustrations show front and side views of the drum, and also views of the complete meter—both in tin and cast-iron case.

The drum being of fixed capacity within itself, the extraneous mechanism and arrangements are of the most simple character. These include all that is necessary, but exclude all that would be superfluous.

W. & B. COWAN,

ESTABLISHED 1827

SMITH SQUARE WORKS, WESTMINSTER,	DUTTON STREET WORKS,	BUCCLEUCH STREET WORKS,
LONDON, S.W.	MANCHESTER.	EDINBURGH.

Established 1844.] **ORIGINAL MAKERS.** [Established 1844.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.
Since then we have not Exhibited for Prizes.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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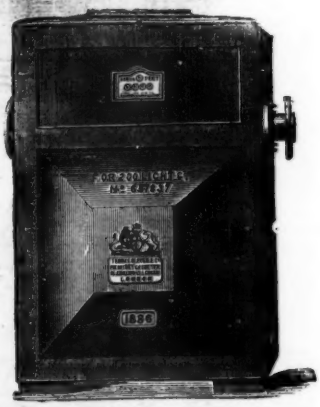
TELEGRAPHIC ADDRESS: "GOTHIC LONDON." TELEPHONE No. 6725

1st—Are a remedy for all the defects of Wet Meters
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by frost, however severe.
5th—Are the most accurate & unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

Meters fitted with Grey's Index or Harding's Counter.



W. PARKINSON & Co.,

COTTAGE LANE WORKS, CITY ROAD, LONDON.

TELEGRAPHIC ADDRESS: "INDEX LONDON."

NEW DESIGN STATION METER (No. 2 PATTERN).

W. PARKINSON & CO. have introduced the above design of Station Meter in order to meet the demand for a more ornamental Tank. It is simpler in construction than No. 1 Pattern, and consequently less in cost. All joints are planed, the most modern improvements introduced, and the entire Meter is of the strongest and most substantial description.

FITTED WITH

PARKINSON'S PATENT THREE-PARTITION MEASURING DRUM.

MATERIALS and WORKMANSHIP of the VERY BEST QUALITY ONLY. PRICES, &c., ON APPLICATION.

Highest Award, Melbourne Exhibition. [See also Advt., p. 976.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TO ADVERTISERS.

ADVERTISEMENTS for the next number of the JOURNAL must be received by Monday, 12 o'clock noon, to ensure insertion; but as the Advertisement sheet of the JOURNAL is sent to Press the first thing on Monday Morning, Advertisers will please bear in mind that **Orders for Alterations in or Stoppages of PERMANENT Advertisements should be received Not Later than Two o'clock on SATURDAYS.**

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 21, 1889.

THE RIGHTS AND WRONGS OF WATER GAS.

WATER gas is still the subject of talk in the City and other places "where merchants most do congregate;" and it was very appropriately selected by Mr. J. F. Bell, of Stafford, as the matter for an interesting paper read before the Midland Association of Gas Managers on Thursday last. First, however, with regard to the speculation in water gas shares, it should be recorded that the British Water Gas Syndicate held their first statutory meeting last week, when the Chairman (Mr. Samson Fox) presented a most glowing report of the condition and prospects of the Company; promising the shareholders untold wealth from tributary ventures and profitable work actually in sight if not in hand. Strange is the way of the stock market; for the immediate commentary upon this fascinating picture was a heavy fall in the value of all denominations of water gas shares, which may or may not be recovered again. We cannot pretend to an opinion regarding the course of the quotations for this class of "securities." They rise and fall as mysteriously as though they had some proper motion of their own, apart from their surroundings. Meanwhile, Mr. Samson Fox has got into an angry controversy with some of the critics who have ventured to question the value of the patents on which his Syndicate is based; and this will not do either him or the Company any good. It is at least satisfactory to learn, on the authority of Mr. Samson Fox himself, that no more public issues are to be permitted until the autumn, "in order "that before that time arrives the numerous orders in hand "shall have been actually executed." This is a very prudent resolve on the part of the Board of the Syndicate, for it will allow matters to develop, and permit of the testing of water gas on a working scale without confounding the manufacturing with the speculative profits of the business. Things will naturally quiet down when there are no fresh issues to agitate the investing public.

Mr. Bell, at the Midland meeting, set himself to show that water gas compares very unfavourably with coal gas; and he had not much difficulty in doing this, to the great satisfaction of his hearers. The paper was very carefully prepared, and will form a valuable addition to the published transactions of the Association. To those who have studied the question, a good deal of what Mr. Bell has to say will appear like "slaying the slain;" for it is certain that if water gas had been endowed with all the advantages claimed for it by its modern partizans, it would have long since established a position alongside coal gas in this country to which it has never approached. It cannot be denied that Mr. Bell fully maintains the position that water gas has no chance of success in England as a general lighting and heating agent in the same sense as coal gas; but it is open to a partizan of water gas to say that there are bypaths of industry for which the latter may be well adapted, and which are not actually occupied by coal gas. It is notorious that Mr. Samson Fox and his supporters claim a great deal more than this; but, in order to arrive at the truth of a matter, it is advisable to follow the middle line between enthusiasm and negation. We should very much like to see the question of water gas fully thrashed out, not as a question of town lighting and heating, because that is obviously out of the range of its capabilities, but in regard to its value as a clean, powerful, and cheap fuel for factory use. It is idle to deny that coal gas, at the ordinary selling rates, makes little or no progress in competition with solid fuel for the larger uses of industries requiring heat. It has fully won its position as a heating agent in a small way; and the aggregate of small gas fires, furnaces, and ovens is already a respectable one, although not so large as it might have been but for the invincible conservatism of many people. The manful attempts that have been made from time to time to adopt coal gas for heating boilers, ovens, large forges, and similar purposes requiring great heat, have not repaid the pioneers according to their deserts. The result might have been different if gas manufacturers had adopted Mr. Henry Woodall's proposals, and sold gas for such purposes at half the usual rates. But, as a matter of fact, they have not done so—whether wisely or unwisely need not be discussed now; and the consequence is as we have stated it. The adaptation of coal gas for the larger purposes of manufacturing industry languishes. Here and there we hear of a gas forge, a gas oven, a gas drying-stove, a gas muffle. The adoption of coal gas for such purposes is, however, sporadic; and one never knows how long it may be persisted in after attention has been drawn to the experiment.

There is only one cry in these cases: "We like the gas; "but it is so dear. Why should we, who use so much in "this way, be expected to pay as high a price as the people "next door for the little they require for lighting?" The response to this very natural appeal is obvious. Coal gas has to be made in the same way, of the same quality, distributed in the same manner, and the accounts of sales passed through the same routine, whatever may be the use to which the consumer puts it. The statutory gas manufacturer cannot help himself, or extend the assistance to the experimentalizing consumer which he would often be disposed to render

if he had a free hand. He is obliged to tell the consumer that the price of gas is so much, and cannot be altered. It must therefore rest with the consumer to decide whether at the stated rate it is worth his while to use it largely for any trade purposes; and all the gas maker can do is to promise to afford a full and sufficient supply. Notwithstanding that all this may be fairly explained to the enterprising consumer, he is apt to think himself ill-treated in not receiving the special consideration which he regards as his due, and to accuse the gas company or the gas committee of neglect of their best interests, obduracy, and other crimes and offences towards himself individually and as representing an order of tradesmen who deserve encouragement. So he does deserve encouragement—there can be no doubt of it. The factory owner who proposes to experiment with gas for a purpose previously served by coal is a public benefactor; and it seems to him hard that when he lays out his money in new plant, which may be changed again and again before it is finally successful, the gas which he uses, and generally begins by wasting, should be charged at the full price. If he succeeds, the gas companies benefit from his enterprise; if he loses, the loss is his own. It is as easy to argue on the other side. The consumer may exclaim that he is quite willing to put up with a supply of gas not so good or so scrupulously purified as the rest, if it could only be sold to him at a cheaper rate. The reply is still a *non possumus*; and so the matter rests.

Here is the opening where water gas should be properly tried. It is only half as strong a fuel as coal gas; but it is much more easily and quickly made. Not one-half of the ground area required for coal-gas making is needed for water-gas plant. Purification is reduced to a simple process of condensation; and the gasholder becomes a mere compensator or governor. Does it not appear at least possible that good use could be found in many factories for a clean, smokeless fuel, made as required on the spot, and costing (say) from 6d. to 9d. per 1000 cubic feet? If it is only half as valuable as coal gas, where can a manufacturer get coal gas at 1s. or 1s. 6d. per 1000 cubic feet? In this field makers of coal gas need not entertain any jealousy of water gas; indeed, it may be to them a friend, for there are many places where, if water gas is made at all, it must be from coke. It is sincerely to be hoped that the existing repute of water gas, absurd as its extreme developments undoubtedly are, may not pass away and leave this kind of fuel once more in the obscurity and neglect from which it has been dragged, before its capabilities for manufacturing purposes are fairly tested. There are not so many varieties of smokeless fuel in the country that water gas should be depreciated undeservedly, however necessary it may be to protest against the ridiculous claims made for it by interested speculators.

EIGHT-HOUR SHIFTS.

In connection with the subject of gas stokers' hours of work and wages, it will be seen that in another column Mr. J. P. Leather writes to remind us that the system of eight-hour shifts, which we had believed extinct in England, is in vogue at Burnley, where it has worked, apparently to the general satisfaction of employers and employed, for the past fifteen years. There are a variety of customs in different British gas-works; and, in regard to this matter of carbonizing shifts, there is great diversity of practice, frequently traceable to the progressive development of the work of the retort-houses from the era of ovens down to this present age of through retorts, generator furnaces, and mechanical aids to drawing and charging. We knew that eight-hour shifts had been tried in different places; but had certainly received the impression that they had been abandoned. If there is any other gas manager besides Mr. Leather equally qualified to elucidate this point of carbonizing practice, we shall be very glad to hear from him. The malcontents who are clamouring for an eight-hour day in the London gas-works would not be content with such a mere rearrangement of shifts as that described in Mr. Leather's letter. They want to do less work as well as a shorter shift; arguing, as may be seen from our report of the recent mass meeting, that they are at present being killed by their labours. Nobody wishes to hurt the men; and it strikes us that they will have some difficulty in proving their allegation as to the work being harder now than it used to be. Gas stoking, with twelve-hour shifts and even no Sundays off, has always been accounted a healthy labour; and men grow grey at it now as they have done any time since the first furnace was fired up. If there is really anything besides "labour politics" in the question at present, we should like to have it argued out in our columns, where both sides shall have fair play. As already stated, however, we do not see anything but labour politics in the agitation, which only needs a "Social Demo-"cratic" member of Parliament at its head to be distinctly branded for what it really is. The onus of showing cause for a shorter shift and less work distinctly lies upon the men; and up to now they have said nothing to convince an impartial observer that the agitation is not wholly factitious.

A GASHOLDER ACTING AS A SEISMOGRAPH.

The article published in last week's Journal, in which Mr. W. Mann describes the effect of the Krakatoa eruption of 1883 upon the pressure record of a gasholder at Batavia, 83 miles away, is unique of its kind. It is not only interesting as a disclosure of some of the difficulties attending gas supply in uneasy tropical regions, but it arrests our attention by its evidence of the way in which industrial appliances occasionally contribute to the elucidation of problems in pure natural science. If it had not been for the faithful pencil of the pressure register in the gas-works at Batavia, one of most striking records of the great cosmical disturbance of August, 1883, would have been lacking. As Mr. Mann truly says, the general aspect of the pressure register for that day gives one a lively idea of the condition of the atmosphere, for oscillations of pressure ranging through 40 millimetres of water were continuous for several hours. Then came the tremendous "sough" originating at Krakatoa, and the long-suffering pressure-rod fairly jumped over the top of the paper. We may take it for granted also that the people of Batavia who happened at the time to be consuming gas jumped also, for the spasmodic rise of the gas pressure, and the subsequent rebound of the holder, must have been repeated in every gas-burner throughout the astonished town. Fortunately we in these islands are not exposed to violent earthquakes; but even here, and in the steadiest of European lands, there are occasional tremors of the ordinarily solid earth which ring bells and jangle crockery, to say nothing of displacing chimney-pots and shaking beds. Perhaps it is due to the slightness of these movements; but we do not remember any record of them in connection with gas-pressure registers. Yet in point of fact a large gasholder is not a bad seismograph, being, while in use, always susceptible of upward and downward oscillations, if not of movements of translation. Small, unsteady, and light holders are continually being agitated by the ordinary breezes to which they are exposed; and their indications of varying pressures cannot be relied upon as possessing any particular scientific value. The case is different with large, heavy, and steady holders; and it would be interesting to see what traces, if any, their pressure registers would show of the passage of an earth-tremor considerable enough to be noticed by other means.

TOWER LIGHTING *IN EXCELSIS*.

The French newspapers, and after them the English, were full last week of reports of the opening of the Paris Exhibition, in which the Eiffel Tower is described and discussed, until it might well be thought that this gigantic finger-post is the exhibition itself, instead of being merely a catchpenny feature of it. There is something very childish in the *furore* that has been made over this piece of wrought-iron work, which, in paying for itself by fees levied for ascents, and in drawing people to look at it, will have discharged the chief duties for which it was designed. It is expected that the great elevation of the campanile of the tower may render possible a variety of meteorological observations which cannot be carried out even on the summit of a mountain, because in this case there will be no disturbance from the influence of the surface of the earth, and electrical communication between observers at the top and bottom will enable them to correct each other, and thus ascertain the net effects of altitude in a way never before accomplished. It may be hoped that the expectation will be fulfilled. Engineers will like to know the effect of height in regard to wind pressure; and there may be other points of the same kind, wherein pure and applied science meet, on which the tower observatories may be able to supply useful information. That one day last week the top of the tower was in sunshine while the lower portion and the grounds of the exhibition were under a heavy thunderstorm, is only what might be expected. It is reported that the displays of electric lighting from the top of the tower are of a remarkable character; as well they may be, for the most infatuated upholder of the "tower system" of electric lighting, in the

early days of the electric light fever, never dreamed of such a magnificient lamp-post as this. But the powerful currents and large arcs required to give anything like a good effect at such heights from the earth-level, from which they must be observed, will make this particular display of "tower "lighting" a costly matter before the exhibition closes.

THE SALARY OF THE DEPUTY-CHAIRMAN OF THE LONDON COUNTY COUNCIL.

After a cruel period of suspense, Mr. J. F. B. Firth, M.P., has attained what people who do not believe in the disinterestedness of many public men of his stamp have all along declared to be the goal towards which he has been straining for years. He has been granted a salary of £2000 a year for performing the arduous work of Deputy-Chairman of the London County Council. It is to be hoped that he will enjoy the pay as long as he earns it by an irreproachable devotion to public duty. We are not among those journalistic and other censors of the proceedings of the Council who feel impelled to stigmatize this arrangement as a flagrant job. The Chairman of the late Metropolitan Board of Works received an equal allowance, and nobody complained. The Lord Mayor of London gets a great deal more; and it is regarded as quite right and proper. Why, therefore, the working head of an administrative body who, if he does his duty, will have to work harder than either of these dignitaries, should not be fairly remunerated, is, on the face of it, difficult to understand. Whence the objection arises is, on the other hand, easy to divine, having regard to the circumstances of the case. Mr. Firth may, in a way, be described as having earned his reward; but those who say this cannot speak of his past efforts as an agitator for municipal reform as disinterested. He was largely instrumental in keeping before the public the question of reform in the local management of London; and having been returned to Parliament nominally as a representative of Dundee, he not only took a lively interest in the progress of the Local Government Bill through Committee, but procured the insertion in the measure of a clause enabling the Deputy-Chairmen of County Councils to be paid for their services. That he should have afterwards found himself occupying the very position for which he made this happy provision may be regarded either as a fortunate coincidence or as a point in the development of a deeply-laid scheme, according to the point of view of the observer. Mr. Firth, moreover, happens to be one of those absentee members of Parliament for Scotch constituencies to whose very remarkable numerical strength attention was recently drawn. It has been suggested that, now that he has become a paid officer of the London County Council, he ought to retire from the nominal representation of Dundee. This, however, he has not yet shown any intention of doing; nor is there much reason, from his standpoint, why he should offer to take any such course. He is quite as good a local representative now as he ever was; and if this is not saying much, it is more to the discredit of the electors of Dundee than to their stranger member. Of course, anyone who still believes that the localized designations of members of the House of Commons mean something, would be apt to point out the inconsistency of the paid Deputy-Chairman of the London County Council being spoken of in Parliament as the member for Dundee, when asked some question about the lighting of the Thames Embankment. However, the strange inconsistency of our English arrangements of such matters is one of their charms. The worst thing we see about this job of Mr. Firth's salary, if job it be, is that it will tend to lower the tone of County Council morals. If Mr. Firth is to be paid for his eminent services as a municipal reformer in this way, why not the others? At this rate the whole electioneering apparatus would be united to the administrative machine, and we should see another Americanism—the doctrine that "to the "victors belong the spoils"—planted among us. This may be all right and proper in the estimation of some people; but it looks a little strange to unaccustomed eyes.

Mr. W. Carr, accompanied by his son, started last Friday for South Africa, to superintend the erection of the works which Mr. T. Newbigging has designed for the Johannesburg Gas Company.

We understand that Mr. J. S. Dougall, formerly Manager of the Bromley (Kent) Gas-Works, has been appointed Engineer and Manager of the Boston (Lincolnshire) Gas Company, in succession to Mr. W. H. Stout, who lately retired on account of ill-health. It will be gratifying to the friends of the last-named gentleman to learn that he is now very much better, and was present at the meeting of the Midland Association last Thursday.

Water and Sanitary Affairs.

The West Middlesex Water Company have obtained a reversal of the decision of the Kensington Justices, who fined the Company for their supposed illegal neglect to furnish a constant supply of water to Gunnersbury College. The real prosecutors, it would seem, were the Chiswick Local Board, whose advisers appear to have been considerably in fault; at any rate, after weighing the several Acts of Parliament affecting the matter, Justices Mathew and Grantham have now absolved the Company from any blame. The learned Judges have decided that, under the Metropolis Water Acts, the Company were not bound in places not within the Metropolis to give a constant supply of water such as that claimed by the nominal respondent, unless four-fifths of the inhabitants "required" such a supply in due form of law. The provision of the statutes in that behalf not having been complied with, the Company could not be held liable; and, accordingly, the appeal has been allowed with costs. Evidently some wrong-headed view of the law has led to this needless piece of litigation. It may be thought by some that, with the aid of solicitors and counsel, it should have been possible to arrive at a true appreciation of the legal bearings of such a case without appealing to the Magistrates, whose erroneous ruling rendered the subsequent proceedings necessary. The intentions of the Legislature in regard to Water Companies, their rights and liabilities, have been embodied in a series of statutes, some special in their character, others general in their application. Prints of the Special Acts can always be obtained; and it may therefore be assumed that no solicitor would admit being unprovided with the statutes at large, or at all events those that have been passed during the reign of the present Sovereign. The general law in regard to constant supply in the Metropolis is to be found in the Metropolis Water Act, 1871, which required every Company subject to the Act (when called upon to do so in accordance with its provisions) to furnish and maintain a constant supply of pure and wholesome water, at such pressure as would make the water reach the top storey of the highest houses within the water limits mentioned in the Act. The statute carefully sets forth the conditions upon which a constant supply may be demanded, as also the the various powers conferred on the Board of Trade, and which are now exercised by the Local Government Board. The provisions of this Act are perfectly clear and intelligible. The same may be said of the relevant sections of the Water-Works Clauses Act, 1847. The latter Act, subject to any special enactments, governs the question of constant supply outside the Metropolitan area. Of course, it occasionally happens that there is a difficulty in reconciling the provisions of a special enactment with those of a public statute; but it is now well settled that a General Act of Parliament does not repeal a previous particular Act, unless there are express words to that effect, or unless the two Acts are necessarily inconsistent.

The Gas and Water Companies' Directory, Etc.—We have received a copy of the thirteenth issue of the "Gas and Water Companies' Directory," published by Messrs. Hazell, Watson, and Viney, Limited. The volume includes, as is now usual, the "Gas and Water Works Statistics," which were originally issued in separate form. It contains a mass of statistical information which cannot fail to be of value to gas and water engineers and officials.

The Revised Instructions of the Gas Referees.—The Metropolitan Gas Referees, having received inquiries on certain points in their Summer Instructions, some extracts from which were given in the Journal for April 2 last (p. 618), have issued a Memorandum, in which they make the following explanations:—The direction that "a fourth testing shall be made after a further interval of one hour" (at the end of the first paragraph of our extracts) is intended to mean that the testing shall be made in accordance with the requirements of section 7 of The Gaslight and Coke and other Gas Companies' Acts Amendment Act, 1880—viz., after a further interval of "not less than one hour." The direction that "if the gas examiner shall observe, during the testing, that the flames of the candles are not exactly between the two plumb-lines which mark their true position, the testing is to be rejected, and a fresh testing made" (*vide* sixth paragraph of our extracts), refers to the form of photometer prescribed by the Referees—viz., one having the position of the candles fixed and the disc moveable—and not to those in which the disc is fixed and the candles are moveable. The intention of the Referees is that the cubic foot measures shall in future be charged with gas instead of air when used to test the accuracy of the meters; but until the requisite alteration in the connection of the cubic foot measure at any testing-place has been made, they intend the measure to be used as heretofore.

Essays, Commentaries, and Reviews.

THE AFFAIRS OF THE GAS INSTITUTE.

THE following list of nominations for office-bearers in The Gas Institute has been prepared, according to rule, by the Council:—

Presidents	G. Garnett, Ryde.
Vice-President . . .	J. Hepworth, Carlisle.
	W. A. Valon, Ramsgate.
	Harrison Veevers, Dukinfield.
Council.	John Annan, Wolverhampton.
	Thomas Bower, West Hartlepool.
	Robert Bridge, Doncaster.
	John Carter, Lincoln.
	James Lowe, Weymouth.
	John M'Crae, Dundee.
	James M'Gilchrist, Dumbarton.
	Robert Mitchell, Edinburgh.
	W. A. Walker, Worthing.
	S. W. Durkin, Southampton.
	Joseph Heydon, Mansfield.
Finance Committee .	W. D. Child, Romford.
	W. W. Hutchinson, Barnsley.
	A. Mead, Chelmsford.
Auditors	W. Smith, Hyde.
	T. W. R. White, Sherborne.

We are indebted for the information to Mr. W. Longworth, the Honorary Secretary *pro tem.*, who, by the way, must have had a busy time since he took charge of the Institute affairs. It will be noticed that the full tale of officers is made up, as in previous years; although some of them, such as the members of the Finance Committee, will not really be required if the new rules recommended by the present Council should be adopted at the June meeting. Mr. Longworth informs us also that the visit to France, which has been so much debated, will, after all, be paid; the date of arrival in Paris being fixed for June 21. A circular has been issued by the Council, under the regulations of the Birmingham Medal Fund, announcing their intention of awarding the medal this year, and inviting suggestions from the members in regard thereto. It may be remarked, in connection with this proceeding, that the second regulation relating to awards of the medal prescribes that "The meeting of the Council at which the medal is awarded shall be attended by an actual majority of such Council, of whom not fewer than three-fourths shall agree in the award." This condition was intended to apply to a Council of 24; and the award could therefore only be made at a meeting attended by 13, of whom 10 must agree as to the recipient. Now the award is apparently to be made by a Council of 6, of whom 4 could proceed to consider the award, and the agreement of 3 would decide it—unless the rule of the Institute relating to the constitution of a quorum may be held to override this regulation.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(FOR STOCK AND SHARE LIST, see p. 964.)

THE general tendency of the stock markets in the past week was much the same as during its predecessor. Quietness and a cessation from speculation have combined to keep prices from making any advance of note. At the same time there is some genuine buying for investment being done by trust companies and other corporations. The Money Market has been variable, affected chiefly by the process of redemption of Consols and a demand for the settlement. In the Gas Market, transactions have almost wholly centred in one Company's stocks—Gaslight and Coke, especially the "A;" the aggregate of business done in all the rest being extremely small. The knocking about to which Gaslight "A" has recently been subjected is utterly unreasonable. After being run down to 253, it was run up again last week to 263, and will not improbably be higher still by the time these words are before the public. There was nothing whatever in the Company's position or prospects to justify so large a depression and sudden recovery; and we can only hope that shareholders are getting hardened to these violent fluctuations, and serenely indifferent. The 10 per cent. preferences and the 7 per cent. maximum have also made a similar recovery in price. On the other hand, the 6 per cent. debenture is 1½ lower. A little business has been done in South Metropolitans—the "A" changing hands at nearly top price; but quotations remain undisturbed. In Commercials, a couple of transactions in the old stock, at middle figures, were all the business of the week. Suburbans and Provincials have been almost neglected; but Brighton and Hove was marked once at top price. Foreigners offer but little to note. Imperial Continental rose 2, after the dividend was taken off; but it has been very quiet. Continental Union new is ½ better. A small amount of business has been done in almost all the Water Companies. Chelsea was the most active, and rose 3. New River was inclined to be flat, and was done at low prices. The debenture, however, rose 1. West Middlesex was firm. Southwark, which so frequently pursues an opposite course to the rest, was the only stock to fall.

The daily operations were: Very moderate Gas business on Monday. Gaslight "A" was done at 254¾. South Metropolitan "A" was firm. Water was hardly touched. Gas transactions were still restricted on Tuesday; and the only feature was a rise of 2 in Gaslight "A." Nothing was done in Water except in New River, which was rather weak. Gas was a little brisker on Wednesday. Gaslight "A" rose 1 more; but the 6 per cent. debenture receded 1½. In Water, Kent was done at steady figures; but Southwark ordinary went down 1. General strength was the feature in Gas on Thursday. Gaslight "A" and Imperial Continental advanced 1 each; and Continental Union new gained ½. Water was moderately active, but irregular. Lambeth and West Middlesex were firm; but New River and East London were marked at low prices. On Friday, Gaslight "A" made another rise of 2½, and saved the market from being a blank. The 10 per cents. and the 7 per cents. advanced as noted above; and Imperial Continental was 1 higher. In Water, Chelsea was conspicuously active. On Saturday, Gaslight "A" gained 1¼ more; making a total advance of 8 in the week. Chelsea was the sole attraction in Water, and improved 3. New River debenture was 1 higher.

ELECTRIC LIGHTING MEMORANDA.

MAJOR MARINDIN'S REPORT—THE REVIVAL OF THE MAXIM-WESTON COMPANY—AN ELECTRIC LIGHTING COMPANY FOR NEWCASTLE-UPON-TYNE—THE ELECTRIC LIGHT AT THE MELBOURNE EXHIBITION.

MAJOR MARINDIN has, with commendable promptness, made his report on the recent electric lighting inquiry; and the substance of his recommendations, which have been adopted by the Board of Trade, will be found in another column. The matter now awaits the comments of the London County Council; and after these have been received, a Model Provisional Order will be drafted upon the lines now laid down, and applied—with only such modifications as may be imperatively required to meet unusual conditions—to every electric lighting undertaking in London. Major Marindin's first conclusion upon the evidence laid before him is that electric lighting is ripe for supply in the ordinary way to anybody who wishes to have it; and that accordingly a local authority should not have power to exclude by a mere general objection a responsible Company willing to supply their district under statutory regulations. He advises, moreover, that all such supply should be under the statute; thus administering a reproof to the Commissioners of Sewers for their attempt to contract outside the Act for the electric lighting of the City of London. With regard to the vexed question of competition or regulated monopoly, Major Marindin recommends competition on general principles; but he does not lose sight of the practical inconveniences of allowing two Companies to compete for business in the same street. He apparently does not think the time has come when anybody can say with certainty at what price electric lighting can be retailed in London and pay 10 per cent. to the suppliers. He, therefore, looks to a strictly regulated competition—say, as between two Companies, one supplying an alternating and the other a direct current—for establishing this datum at the earliest possible moment. For the present, it appears that 8d. per unit is the maximum rate that can be safely fixed for the whole of London. After seven years, the Orders are to be reconsidered, with a view to fixing an initial price and sliding scale after the model of the Gas Acts, and allowing the undertakers the same standard dividend as the Gas Companies. There does not appear to be much to object to in these recommendations as a whole. The details of the districting as these affect the different Companies applying for Orders may arouse considerable criticism during the next week or two; but with this matter we are not directly concerned. The main point to be noticed now is the way in which Major Marindin has attempted to solve the difficulty of securing the advantages of competition in supply, while avoiding its drawbacks.

A meeting of the Maxim-Weston Electric Company, Limited, was held last week, when it was announced that the prospects of the Company are improving. This statement may came as a surprise to those who have regarded the concern as practically dead; but if the assurances of the new Chairman (Mr. John Marks) are to be believed, the Company are really making a fresh start. We are not sorry to learn that the Brush Company are not to be left masters of the situation, as they would have been if the Maxim-Weston, the only other survivor of the old order of electric light companies who depended upon arc lighting as a specialty, had dropped out of the rank. There can be no doubt that, so far as the lamp is concerned, the Maxim-Weston Company ought to be able to compete well with any other electrical firm; but, unfortunately for them, the system of management of the late Board was anything but what it should have been for the true interests of the Company. It is to be supposed that if the Maxim-Weston Company succeed in rehabilitating themselves, they will remain rivals of the Brush Company—perpetuating, if only in this respect, the traditions of the old administration. It is rumoured, on the other hand, that a great measure of amalgamation is actually under consideration by the principal electric light apparatus companies now having their head-quarters in London. This arrangement, if it comes to anything, may be regarded as a consequence of the alteration effected by recent legislation in the mutual relationship of electricians. The electric light interest is now divided into the two orders of undertakers of lighting and manufacturers of plant. The old order of electrical companies, like the Jablochkoff, Pilsen-Joel, &c., owned and worked patents and undertook lighting contracts as well; and there are still a few of the class left. The more modern arrangement, however, is for the undertakers of lighting to keep themselves distinct from the apparatus manufacturing concerns, although the connection is necessarily intimate, and the former may generally be regarded as the offspring of the latter. It remains to be seen whether by

dividing the offices, the average of the results will show any real improvement.

An electric light company has been established for lighting the Newcastle-upon-Tyne district from a central station; the system selected being that of alternating currents with transformers. To judge from the inaugural address of the Chairman at the recent first statutory meeting of the Company, the Directors mean to go to work on a sensible plan. Of course, their talk is all of the future, as they have done nothing yet; but they appear to be fairly cognizant of the nature of the work before them. The Chairman acknowledges, for instance, that many electric lighting companies have come to grief, but he thinks he knows the reason for this. Indeed, he names three causes for the failure of electric light companies, as follows:—Heavy initial expenses, injudicious selection of plant, working at an unremunerative price for light. These are undoubtedly good reasons, so far as they go; but they are not the only ones, as the Newcastle Company may discover in good time. The Chairman's statement of the question, however, is full enough to serve as the basis for his further announcement that the Company do not mean to cut their throats at the outset of their career by endeavouring to undersell the local Gas Company. They propose "to give a light of a higher order than gas, at a higher price." Just so; this is perfectly fair. Nobody expects a haberdasher to sell silk stockings at the same price as cotton ones. What the Newcastle Electric Light Company have to prove by experience is, first, that their light will be to gas as silk to cotton; and, secondly, that there are sufficient customers in the district to make it worth while to provide the more costly commodity. It is stated that the price contemplated for incandescent electric lighting in Newcastle is 6d. per Board of Trade unit, with discounts for large consumption. The minimum charge and meter rental are not given. This is equivalent to gas at 6s. 6d. per 1000 cubic feet, besides extras.

An account has come to hand of the electric lighting of the Melbourne Exhibition, which was carried out by the Australasian Electric Light Company. The figures were prepared by the Secretary of the Company, and make a very good show for electricity. It appears that the total area of buildings lighted by arc lamps was 1,142,821 square feet, and those lighted by incandescent lamps had an area of 163,006 square feet. For the former, 915 lamps were used, with an illuminating power rated at 924,000 candles; being a little over 1000-candle power per lamp—a remarkably modest estimate for Brush lamps. The average floor area lighted by one lamp was therefore 1249·9 square feet, and the average illumination of the floor was 0·808 candle per square foot, which is sufficiently bright if the floor is not over-encumbered with show cases, and if the walls are tolerably light. The average area of floor space per incandescent lamp was 85·9 square feet, giving an average intensity of 0·268-candle power per square foot of floor space. From this we should say that the incandescent lamps must have been intended to be looked at rather than to give light. In the concert hall the incandescent lighting was increased to 0·578-candle power per square foot of floor. Even this cannot be considered brilliant in comparison with the reported duty of the arc lamps, more especially as the report elsewhere admits that from 0·66 to 1 candle power should be allowed for every square foot of floor space, if an interior is to look bright and cheerful at night. It is by no means clear from the report what the lighting of the exhibition actually cost. The running expenses are stated at £300 per week; but the initial cost of plant is rendered uncertain by making a variety of deductions and allowances. The figure of £60,000 is given, reduced to £30,750 by assuming a depreciation of 50 per cent. all round on the plant employed. By this means it is made to appear that electric lighting costs considerably less than gas at current Melbourne rates; but we cannot venture to express an opinion as to the correctness of this statement, seeing the source whence the data are supplied. The Secretary of the electric light company may mean well; but it would be necessary to have the criticism of a local gas engineer, or at least the endorsement of an independent authority, before one could be quite sure that the whole of the story has been fairly told.

Proposed Scheme of Gas-Meter Inspection for Chicago.—The Municipal Council of Chicago contemplates the appointment of an Inspector of Gas-Meters, whose duty is to be the semi-annual inspection of all meters within the limits of the city, for which there is to be a charge of 50c. per meter, one-half of which is to be paid by the Gas Company, and the other half by the consumer. "Such a proposition," says *Light, Heat, and Power*, "might provoke a smile, were it not for the very evident fact that it is made in a sober manner, and with the intention of enforcement, should such enforcement be practicable. The possibility of an attempt of this kind, made by the constituted authorities of one of the largest cities in the country, becomes a serious matter, chiefly as evidencing the inborn determination of political legislators to continually harass light-furnishing corporations in one way or another, and generally from motives best known to the agitators of public *furores*, who are whirled into places of authority through the miry evolutions of precinct politics." Our contemporary regards this new piece of "asininity" on the part of the local authority of Chicago as a living evidence that the gas companies of America should be constantly on the watch to protect their interests; and some scheme of mutual protection should, it is thought, find favour in every State throughout the country, especially in view of the growing tendency of American legislators to harass corporations whom they may have wholly or partly in their power.

CONCERNING FURNACES.

Last week the London newspapers contained another of those reports of offences against the Smoke Prevention Acts which furnish such a striking commentary upon modern practice in the utilization of fuel. A factory-owner was summoned before a Magistrate for polluting the air with smoke from his furnaces; and the defence was nothing else than a plea of justification by necessity. The defendant urged that he had a right to live by his trade; and his trade entailed a smoky chimney, because the profits did not allow of his burning anthracite, and neither he, the defendant, nor two expert witnesses whom he had brought into Court to take his part, knew of any really efficient smoke-preventing description of furnace. The Magistrate, who had probably heard something about the smoke abatement movement, was somewhat impressed by this evidence. He asked the offender whether he had ever tried any so-called smoke-preventing appliances, and was answered in the affirmative, with the assurance that, although these devices cost money, and involved more or less trouble, they were no good. It was asserted that the supposed efficiency of these arrangements depends more upon the complaisant blindness of the constables on the beat than on any real virtue of their own; and the accused in this case ascribed his getting into trouble to the advent into his district of a fresh and inconveniently watchful policeman. What a statement is this, to be put forward as a criticism of the smoke-preventing efforts of modern engineers! The argument turned out to be an unfortunate one for the user; for the Magistrate, with a heartily expressed wish that there were more constables of the same character, fined the defendant 40s. and costs, and without venturing upon any remarks on the general quality of mechanical appliances for abolishing or modifying smoky fires, advised the offender to buy a better class of fuel for the future. Possibly the victim of what he probably regards as a bad law tyrannously administered, will turn his attention to coke if he cannot afford Welsh coal. This incident comes very appositely at the time when a Company is being launched to exploit the Hopcraft furnace, of which some great things are expected. As this arrangement appears to embody some, if not all, of the points that may be regarded as settled in regard to the burning of bituminous coal with the minimum of smoke, it will be well to describe it in some detail. In the first place, it depends upon three cardinal principles, which are applied in combination—under-feeding, forced draught, and continuous automatic feeding. The firegrate is circular; consisting of concentric rings of cast iron, and slowly revolves on its axis, which is inclined towards the bridge at a considerable angle. Between it and the bridge is another and horizontal grate, which receives and can automatically discharge the clinker and ash from the first grate. In front of the boiler is a hopper for fuel, connected at the bottom with a tube terminating underneath the revolving grate, through which an endless screw propels the coal, which is constantly forced upward at last into the body of incandescent fuel. As the green fuel approaches the hot fire, it gradually carbonizes; giving off the volatile and smoky gases contained in it, which have to pass through the glowing mass, where they also meet the air-blast, and are consumed. The proportions of air and fuel are regulated so as to ensure a satisfactory combustion, first of the gases, and then of the coke; the process being continuous as long as the furnace is in operation. All this reads very well; and it can be readily understood that if everything works properly, the smokiest of bituminous slack ought to be burnt efficiently and unobjectionably by such a furnace. It remains to be proved, of course, that the mechanical arrangements do work satisfactorily for any length of time, and that the economy of the furnace compares favourably with the results of of stoking by ordinary methods.

We have gone into these particulars of the Hopcraft furnace, and prefaced the account with evidence of the need of something of the kind, for the purpose of drawing attention at once to the pressing occasion for the development of that branch of engineering which is concerned with the industrial use of fuel, and also to the conditions under which the problem may be most hopefully attacked. For it would be absurd to say that Mr. Lewis Hopcraft has uttered the last word on this matter, and that his present invention is perfect. The working of the under-feed arrangement which he has adopted, may easily give trouble, and absorb a fatal amount of power. As for the question of forced draught, this modification of furnace working is admitted to possess advantages altogether apart from its combination with any special stoking appliance. We have already pointed out the desirability of a thorough examination of this system of intensifying combustion, and shall say no more now on the point. The problem of burning bituminous fuel smokelessly appears to depend upon the introduction of the fuel into the fire in such a way that carbonization shall be attended with instant combustion of the evolved gases and tarry vapours, which is the very reverse of what happens when a fresh supply of green fuel is thrown upon a glowing fire. As already stated, the most obvious way of securing this object is to add the coal to the fire at the bottom instead of on the top. Automatic mechanical and continuous feeding may be, and undoubtedly is in many cases, a very desirable accompaniment to this process; but it is not essential to it. There are many furnaces for which mechanical stoking is out of the question, yet which make, and will continue to make a great deal of smoke, unless they are taken in hand by some yet undiscovered genius in the art of smoke prevention. The greatest difficulty in the way of under-feeding a fire

lies in the unmanageability of the lumps of fuel. A piece of coal of any size that a coal merchant will send out may be dropped upon the top of a fire; but how to get it in at the bottom? Then again, the rate of combustion is to be reckoned with. Underfeeding means, as a rule, slow combustion; whereas, for factory purposes, most fires should be brisk. It is useless to show a factory owner a way to burn coal smokelessly unless at the same time the useful duty of his furnace is maintained.

It is a good sign that the old nomenclature is changed, and that there is no longer any considerable talk of smoke-consuming apparatus, but smoke prevention or abatement is spoken of instead. It has indeed been abundantly proved that there is no way of dealing with smoke when once formed; it must be grappled with if anywhere at the very birth. Neither is there of necessity any noticeable economy in a smoke-preventing arrangement, having regard only to the calorific value of the carbon burnt, instead of being sent up the chimney as smoke, or deposited in the flues as soot. It has been determined that the volumes of thick black smoke poured out of the funnel of a steamboat, although apparently solid enough to be caught in bags and tipped into the stoke-hole again, represent an actual loss in weight of but a few pounds of carbon per ton of fuel burnt. The advantage is, therefore, rightly sought in the capacity of improved stoking appliances for utilizing slack, dust, and other cheap varieties of bituminous fuel, the extreme smokiness of which, when burnt in the ordinary way, is only one of their disadvantages. All this is hopeful for future success; for the first necessity in solving a problem is an exact knowledge of its real bearings.

It is often said of gas companies, almost contemptuously, by people who claim to speak as scientific authorities, that they may find plenty of work in the future, when it is assumed that their present business of supplying light has passed into other hands, in cultivating a trade in smokeless fuel gas. This saying has indeed become almost a figure of speech, and is kept in circulation, like many a piece of bad money, by the haste of the utterers, whereby they are prevented from examining it closely, and so detecting its spurious quality. We do not cherish any illusions on this score. When gas companies cease to supply the bulk of the material required for the artificial lighting of towns, their prosperity will be at an end; but of this eventuality there is not the faintest sign at present. Gas manufacturers do actually supply more smokeless fuel than is available from any other source, in the shape of gas and coke. As their output of coke is likely to increase year by year, it is eminently desirable that these discussions of the problem of providing British industry with a smokeless fuel should be kept alive. We take the closest interest in the progress of the movement in favour of rendering all furnaces smokeless, because, for one reason, anything that improves the working of industrial furnaces not only tends to force coke into prominence, but also helps to render it available for purposes to which it is not now generally applied. The adoption of a forced draught, for instance, which, under Messrs. Donkin's care, has enabled the worst descriptions of breeze to rank as a useful fuel, may do even more for coke than it can for coal. Many other devices intended to intensify the process of combustion are similarly susceptible of wide application. Apart from all these considerations, engineers employed in any industry necessitating extensive consumption of any kind of fuel cannot but be interested in all advances of that department of practical science which may almost be regarded as worthy of a special name, in order to signify the art and practice of firing, stoking, furnace management, design, and construction. It is a study of itself, and one in which the best theory and the most enlightened practice will yet find wide scope and great reward. It is a subject, moreover, that will always receive the most sympathetic treatment in the pages of the JOURNAL, which counts amongst its readers men who may without flattery be described as the most experienced practitioners in this line in the world.

ACCORDING to the *South Wales Daily News*, the Lothammer Gas Company are taking steps for carrying out installations of their light in Cardiff and Swansea; and the issue of a prospectus of the South Wales Lothammer Gas Company may be expected.

THE exhibits of Messrs. Evans and Sons, of Wolverhampton, at the Melbourne Centennial Exhibition, gained for this firm four additions to their already numerous awards. For their steam and hand pumps they obtained a gold medal; two similar medals for their Evans-Tonkin patent Cornish direct-acting pump, and their duplex and other steam pumps; and a special gold medal for general excellence of manufacture.

THE return furnished by the Chemist and Superintending Gas Examiner (Mr. W. J. Dibdin, F.I.C., F.C.S.) to the London County Council, on the results of his testings of the gas supplied to the Metropolis during the week ending the 14th inst., shows that on six occasions the illuminating power was below the standard—in four cases to the extent of 0·2, in one to the extent of 0·3, and in the other (cannel gas) to the extent of 0·1 candle.

ON the 20th of March last, His Excellency the Governor of New Zealand laid the foundation stone of the building in which the forthcoming exhibition, for which active preparations are being made in the colony, is to be held in Dunedin. In view of this fact, the Directors of the City of Dunedin Suburban Gas Company, Limited, are taking steps to connect their nearest main with the exhibition grounds, so as to obtain facilities for making a suitable display of gas appliances.

Notes.

THE SPRINGER WATER GAS PROCESS.

The most improved system of water gas production now favoured in the United States is reported to be the Springer process, the patents for which are owned by the National Gas Light and Fuel Company, of Chicago. The object of this process is to produce water gas carburetted by the locally cheap Lima crude petroleum, which is of a quality that does not pay for any refining. The *American Manufacturer* recently illustrated a Springer cupola now being built for the Alliance Gaslight Co., of the town of Alliance, Ohio, which may be taken as the type of the latest improved apparatus. It consists of a wrought-iron cylindrical shell, lined throughout with fire brick, and provided with the necessary doors for charging and cleaning, and with pipe connections for steam, air, and oil. The cupola is a very tall one, being about 28 feet high and 4 feet diameter. At rather lsss than half its height it is divided into two portions, by a solid firebrick arch; the upper portion being called the superheater and the lower the generator. Connection between the two portions is made by means of a fire-clay lined bye-pass, controlled by a valve. The generator contains a furnace grate and closed ash-pit. A fire of hard coal or coke is made on this grate; and the valve between the generator and superheater being opened, an air blast is turned on, part of which supplies the initial combustion in the generator and the remainder enters the bottom of the superheater, where it ignites the generator gas. The upper portion of the superheater is filled with open work of fire bricks, which absorb the resultant heat. The fuel in the generator having been brought to a state of incandescence, and the fire brick of the superheater having been heated to a light orange colour, the blast is shut off, the lid of the cupola closed, and the gas outlet valve opened. The apparatus is then ready for making water gas. The steam connections provide for sending a current of steam through the fire in either direction, depending upon the state of the fire. In any case the gases resulting from the decomposition of the steam in the fire pass up into the superheater, into which at the same time the crude petroleum is admitted. The oil becomes vapourized by the heat of the fire bricks; and the vapour mixing with the hot gases from the generator unites with them, and the result is a fixed gas. When the heat of the cupola falls below a certain point, the oil and steam valves are closed, the lid opened, coal or coke added if necessary, and the air blast turned on, thus completing the cycle of operations. An apparatus of the size described here will make 80,600 cubic feet of gas per 24 hours. The Company are building three cupolas of the same type for the Chicago Gaslight and Coke Company, but larger; each cupola having a capacity for making 750,000 cubic feet of gas daily. It is claimed that by this system a gas of 22-candle power is made, with a consumption of from 30 to 40 lbs. of coal or coke and 5 gallons of Lima crude oil per 1000 cubic feet.

AN AUTOMATIC REGISTERING CHEMICAL PHOTOMETER.

When a mixture of equal volumes of hydrogen and chlorine is exposed to light, a combination of the two elements is brought about, and the quantity of hydrochloric acid formed is proportional to the quantity of light received by the mixture, which would have remained unaltered for an indefinite time in obscurity. The experiment is a classical one in chemistry lectures, when it is generally carried out to the point of explosion, in order to duly impress the students. The reaction is none the less complete when carried out without noise. This principle of an apparatus for chemically measuring the effect of light has long been known; but although Draper, Bunsen, and Roscoe have tried to embody it in a satisfactory appliance, the result has not been good, whether from want of precision on the one hand or excessive complication on the other. According to M. Delahaye, however (writing in the *Revue Industrielle*), M. Dessandier has recently presented to the Société de l'Industrie Minérale a registering photomer based upon this principle. No illustration of the apparatus is given, which limits the description to its method of working. The mixture of equal parts of chlorine and hydrogen is formed by the electrolysis of hydrochloric acid. It is contained in a glass tube, which is kept inside a protecting cylinder, and is consequently preserved from exposure to light until the moment of operation. This cylinder is mounted on a small cylindrical vessel called the exposure chamber; and in displacing it an annular slot is uncovered, through which the mixture is exposed to light. The hydrochloric acid formed is absorbed by a convenient liquid; and ingenious arrangements assure the maintenance of the remaining gaseous volume at a constant pressure. The gas-tube is lowered proportional to the process of absorption, and this movement, registered upon a revolving screen, corresponds to the intensity of the light, since the volume of gas exposed to its influence is always the same and at the same pressure. M. Dessandier has applied the apparatus to the purposes of photography, and by a special combination has made the production of impressions automatic. It remains to be seen for what further uses and developments the apparatus may be rendered available.

A CREOSOTE FORGE.

The Lucigen Light Company have made a fresh departure in the application of their principle of burning creosote, &c., for forge work. The furnace, which is called "the pyrigen," is reported to be capable of heating rivets and metal for all kinds of smith's work to a white heat very quickly, and without oxidizing, sulphurizing,

or in any other way injuring the material. A great convenience of this arrangement consists in the fact of its being without smoke or fumes, and it may therefore be used in enclosed places where the ordinary class of forges could not be employed. The fuel, as already stated, is any kind of cheap heavy oil, and the flame is fed with compressed air, as in the lucigen light. Indeed, the furnace may be described as a lucigen made to do heating instead of lighting duty, by the addition of a closed furnace constructed of wrought-iron plate lined with fire-tiles and provided with a chimney. The oil flame is admitted at one end of the tile-lined box, which in one example is 24 in. long, 15 in. wide, and 10 in. high, and is projected straight through it, striking a fire-clay block at the opposite end, from which it returns, and the waste products of combustion ultimately leave the box by a flue placed immediately over the inlet. A full heat for rivets can be got up in 15 minutes from lighting the flame. The pyrigen can be economically worked in connection with the lucigen light, as the same supply of compressed air serves for both. With regard to cost, it is stated that in a large works in the neighbourhood of London, where these furnaces are used, a careful comparison has been made between their working cost and that of breeze furnaces, and shows a saving of three-fifths in favour of the oil. It is a similar system to that successfully used for heating the rivets on the Forth Bridge works.

THE EFFECTS OF CARBONIC OXIDE UPON THE BLOOD.

A statement by Professor W. P. Mason, of the Rensselaer Polytechnic Institute, respecting the poisonous character of water gas appears in a recent issue of the *American Gaslight Journal*. He refers to an event in the history of Troy, in the State of New York, where owing to a break in the street-mains a quantity of fuel gas passed underneath the frozen crust of earth and percolated into the adjoining houses, causing four deaths and many more or less serious illnesses. The composition of the gas by volume was: Carbonic acid, 5; oxygen, 0·5; carbonic oxide, 37·5; light hydrocarbon, 0·9; hydrogen, 48; nitrogen, 7·1. It was practically odourless; and gave no warning of its presence in dangerous quantity in the atmosphere of the houses. The unconscious victims died without any struggle, their appearance when found indicating that the insensibility which passed into death overtook them without creating any previous alarm, or disturbing them from their occupations and attitudes at the moment of seizure. What is most remarkable is that fires were burning and lamps lighted in the rooms invaded by the poisonous gas, which was therefore strong enough to kill without being strong enough to form an explosive mixture. Very searching *post-mortem* examinations of the victims were made without disclosing anything abnormal, with the exception of the bright cherry-red colour of the tissues, and the vivid redness and fluidity of the blood. When the operating surgeon opened the chest cavity, he endeavoured to detect any unusual odour, and was immediately affected with giddiness, and the subsequent oppression did not wear off for twelve hours. A lawsuit followed the accident, and Professor Mason was retained to analyze and experiment upon the fuel gas and its effects on living animals. In this way the analysis already given was made. It is placed upon record by Professor Mason that, both microscopically and by the spectroscope, the effects of carbonic oxide poisoning may be detected in a sample of blood kept in a bottle and not examined for a year after the death of the animal from which it was taken. Even after two years such a sample of blood will still retain the characteristics noted when first inspected.

DEATH OF MR. JAMES SIMPSON.—We regret to record the death of Mr. James Simpson, M. Inst. C.E., &c., the eldest son of the late Mr. James Simpson, Past-President of the Institution of Civil Engineers. The deceased was the head of the well-known firm of Messrs. J. Simpson and Co.; and his name will always be remembered in connection with the compound engine, and more especially with compound pumping-engines, as he made them for most of the principal water-works at home and abroad. Mr. Simpson, who was sixty years of age at the time of his death, was buried at Brompton Cemetery last Wednesday morning; and, in addition to his own relations, a large number of friends and of the *employés* of the works were present.

GAS-ENGINES FOR MOTIVE POWER IN GAS-WORKS.—The use of gas-engines for driving the exhausters, and for other purposes requiring motive power in gas-works, has frequently been advocated and has been found advantageous when adopted. According to particulars which have reached us of some trials lately made at the works of the Filey Gas Company, the "Campbell" gas-engine has shown itself to be well adapted to take the place of a steam-engine. In the case in question, the engine was employed to drive a 5000 cubic feet per hour exhauster; and this it did so satisfactorily that the Company's Engineer (Mr. J. Moon) expressed his entire approval of it. Of course, the great advantage of a gas-engine is its capacity to adapt itself to the varied demands made upon it; and this quality the "Campbell" engine appears to possess in a high degree. It is very light in weight per horse power, is easily fixed and worked (the speed being changed by simply altering the weighting of the governor), and is economical in operation; while the gas being supplied from one meter prevents any misunderstanding as to the quantity consumed. Owing to there being an ignition at every revolution, the engine runs very steadily when working at its full power; while the interchangeability of the parts minimizes the expense of repairs. These are features which have secured for the "Campbell" engine very marked success.

Communicated Article.

PHOTOMETRY.

By H. LEICESTER GREVILLE, F.I.C., F.C.S.,
Chemist to the Commercial Gas Company.

The publication of the article by Mr. John T. Sheard, on "Photometry and its Substitutes," in the JOURNAL for the 30th ult., leads me to the reflection on the comparative frequency with which an interesting subject is started in an article without exciting either comment or discussion. However good and accurate an article on some special subject may be in itself, there is generally scope for other views of the question. With this prelude, I shall not hesitate to follow Mr. Sheard's lead on the photometry question, more especially as the subject is such an extensive one. I agree with Mr. Sheard in much that he has said, but not in all. With regard to his criticism of the recently-issued Instructions of the Gas Referees, I have little to add, except that I think a distinct advance towards justice and accuracy has been made. The reading from different sides of the disc, and the rejection of tests varying widely from the mean, are certainly changes in the direction I have indicated. The adherence to the 5-feet consumption is, in my opinion, no fault of the Referees, as I do not consider they have any power to effect an alteration in this detail, in the face of the distinct statement in the Act of Parliament that the gas is to be consumed at the rate of 5 cubic feet per hour. With regard to the candle adjustment, authorities differ very much; and although the recent Instructions are perhaps not so clearly worded as they might have been, a certain amount of advance is apparent in the mere fact of a definite direction being given for the first time.

There is no doubt that on the eve of possibly radical changes in photometrical practice, the two main points of alteration should be the abolition of the rigid 5-feet consumption, and the adoption of a reliable standard in place of the much-abused candle. With so many improvements in gas lighting appliances now at the command of the public, by which much more light is obtainable from a cubic foot of gas than heretofore, surely the gas companies should be at least acceded the right to have the gas tested in the standard burner under fair conditions. To show the effect of varied gas consumption in the standard burner on the light afforded, I will simply quote the two following experiments:—

No. 1 sample of gas gave—

At 4·00 c. ft. per hour,	11·87	candles	=	14·84	candles for 5 c. ft.		
„ 4·50 „	„	14·86	„	= 16·51	„	„	„
„ 5·00 „	„	16·79	„	= 16·79	„	„	„
„ 5·55* „	„	18·70	„	= 16·84	„	„	„

No. 2 sample of gas gave—

At 5·00 c. ft. per hour,	13·99	candles	=	13·99	candles for 5 c. ft.		
„ 6·00 „	„	18·14	„	= 15·11	„	„	„
„ 6·70* „	„	20·65	„	= 15·40	„	„	„

* Just short of smoking point.

In each of these cases the maximum illuminating power was reached when the burner was consuming as much gas as was possible short of smoking. In the case of the richer gas (No. 1), the difference in value for 5 cubic feet when consumed at a little over or a little under the standard rate is not large. With poorer gas, however, as exemplified by No. 2 sample, the great change in light obtainable by a difference in consumption is very marked. An official return of this gas would be (say) 14 candles; whereas, considering that the value of the gas under more suitable conditions would be 15·4 candles, it follows that the gas would be publicly reported at 1½ candles below its proper value, simply because the conditions of gas consumption in the official testing impose such an undue relation between the gas and the air supply as to cause serious sacrifice of light by undue oxidation. The fact conveys all the more hardship to the gas companies inasmuch as, whereas the rigid adherence to a minimum 5-feet consumption, *does not* seriously affect the value of 16-candle gas, it *does* most seriously affect the value assigned to gas of lower illuminating power; and the lower the quality, the greater the effect. An alteration of the present system could obviously be made in three ways—viz., the gas (with a suitable standard for comparison) could be either adjusted to a 16-candle flame, to a 4 inch flame, or to just short of smoking point, the rate of consumption taken, and the value of 5 cubic feet ascertained by suitable calculation. Of the three methods, I should prefer the adjustment to a 4-inch flame, about which there need be no extreme accuracy, and which, while ensuring justice being done to the gas, would prevent possible loss of light by smoking, if the adjustment to "just short of smoking point" were carelessly effected.

With respect to the description of standard with which it is desirable to replace candles, I am strongly in favour of a form of screened flame of the Dibdin-Sugg type, on the ground that, in the first place, the nearer the standard light approaches in value the light to be tested, the nearer the approximation of the distance between the photometer disc and the respective lights, and the less the possible interference of fog; and in the second place, a screened flame is, in my opinion, less subject to fluctuations, arising from varying proportions of atmospheric moisture, than an entire flame. This may be considered a minor point; but with a remembrance of the experiments of Mr. Methven, and of many of my own, on the subject, I know that the effect of the varying degrees of moisture present in the air on the total illuminating value of a flame is by no means a negligible quantity.

Whatever changes may be made in photometry, there is one project I have but little sympathy with, and that is the proposed legalization of tests made by the portable photometer. When there is

full opportunity to place a proper testing-station on a leading main of a gas company, and to make tests at any hour thought desirable by the authorities, it is difficult to understand the *raison d'être* of a portable form of instrument, to be used in any by-street where the gas company may be suspected of secreting a few cubic feet of an inferior article. I presume that the broad construction of the Act of Parliament is that the bulk of the gas sent out by any company should have a certain prescribed lighting value; and if a test off a leading main betrayed that the company were not fulfilling their legal obligations, they would rightly suffer the penalty of transgression. Gas is, however, not an absolutely permanent article with regard to its lighting value; and I regard it as quite possible that obscure points might be selected in a company's district, where, owing to the stagnation of feeble circulation, with its concurrently excessive effects of friction and condensation, the gas might be slightly in default of the 16-candle standard. I do not presume that competent authorities would really select such points for the official testing of gas; but the legalization of a sytem of testing which did not define place as well as method, would allow of such a selection being made if the authorities were so inclined. The injustice of putting forward a test of this description as a public record that the gas supplied by a certain company on some particular day was found deficient in illuminating power, needs no comment. It would be on a par with making a test of some material produced by a large manufacturer from a sample taken from some bye-corner of the establishment, where deterioration of quality might take place, and then quoting the analysis as a fair sample of the bulk of the manufacture.

Mr. Sheard concludes his article with a reference to proposed substitutes for photometry, properly so called. With regard to these, my own opinion is that no method is in the least degree likely to afford an accurate estimate of the illuminating value of a gas, short of absolutely ascertaining the light afforded under conditions of proper combustion, as compared with that afforded by a reliable comparison light. It should be remembered that when we are once in possession of a reliable standard (and I think we are even now in that position), an actual measure of the illuminating power given by a flame consumed in a specified burner under certain defined conditions, is irrespective of the chemical composition or specific gravity of the gas, and therefore is applicable to all gases, no matter from what source they may be derived. It is also a test which is a practical one from a gas consumer's standpoint, as it fixes a value which he can himself realize in the actual use of the material he purchases. Tests founded on specific gravities, hydrocarbon percentages, heat values, &c., may have some use as applied to gas produced from similar materials at constant heats and under uniform conditions; but, even at the best, they would not be likely to be strict measures of illuminating value, and such methods would totally fail when applied to gases produced from different materials under varying conditions. I have had some seventeen years' experience in practical gas testing; and while considering, on the one hand, that the adoption of a reliable standard will ensure greater speed and accuracy in photometrical determinations, there are, on the other hand, many considerations which will in the future have to be taken into account in questions of rigid accuracy, and which will tend, while conducing to make photometry more scientific, to inevitably make it more complicated. Of this I hope to say more at some future time.

THE DINSMORE PROCESS AT WIDNES.—The following is Mr. Isaac Carr's report on the working of the Dinsmore process at the Widnes Local Board Gas-Works up to the 6th inst.:—"On the 16th ult. we commenced carbonizing Arley slack (from the Park Lane Pits, Wigan), and have continued it up to date, with the following results: Coal used, 47 tons 11 cwt. 3 qrs.; gas made, 572,000 cubic feet; gas made per ton, 12,019 cubic feet; average illuminating power, 21·02 candles; tar used per ton of coal carbonized, 7 to 8 gallons. These results are higher than I expected to obtain from such common fuel; and it now appears to me that we may in the future, besides allowing the cannel contract to lapse, use 25 per cent., or about 3000 tons, of slack together with the ordinary gas coal, and still keep up the illuminating power of the gas supplied to the town to from 19 to 20 candles. The price of slack being 40 per cent. less than that of the coal we are using, a very considerable additional saving will be thus effected."

STANDARD WATER-PIPES.—At the meeting of the American Water-Works Association recently held at Louisville, Mr. S. B. Russell read a short paper on standard water-pipes. At present the consumer orders pipes of the desired diameter and thickness. The manufacturer chooses the pattern nearest to this diameter, and calculates a core to give the required weight, but rarely gets the exact internal diameter. This results in considerable annoyance and some loss to the consumer. In America there are 14 sizes of 6-inch pipe, between 27 lbs. and 33 lbs. weight per foot; and still they scarcely keep within limits of 2½ to 5 per cent. variation in the weight. Wrought-iron and lead pipes do not vary so much. Mr. Russell thought the Association were eminently fitted to improve the present condition of affairs, and any plan approved by them would, he said, probably come into general use. The standard series should fix the number of classes, five or six weights for each size. The weights per foot must also be fixed; and the uniformity of pattern (one of which might suffice for each size) would then greatly simplify the joint question. In St. Louis there are four classes of 30-inch, and two classes of other size of pipe, and only one pattern for each diameter.

Technical Record.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Spring Meeting of this Association was held last Thursday; and a large number of members were present to take part in the programme arranged by the Committee, and to accept the hospitality offered to them by the President (Mr. Charles Taylor, of Derby). The main body of members left Birmingham by the 9 o'clock Midland train for Derby, where, on their arrival, they were met by Mr. Taylor, and some few others who had journeyed in direct. An adjournment at once took place to the Midland Railway Company's Offices at the station; and in the absence of Mr. S. W. Johnson, C.E., the Locomotive Superintendent, the party was conducted through the locomotive works by Mr. Holt and his assistants. Much interest was evinced in the extent and diversity of the operations carried on in the works—more especially in the laboratory department, as well as in the testing-room, where elaborate machinery is erected for testing the tensile and compressive qualities of the different irons and steels used throughout the works. After an hour and a half pleasantly spent in this way, the members went to view the Litchurch works of the Derby Gaslight and Coke Company; and the several points of particular interest in the works were there explained by Mr. Taylor and the Station Superintendent (Mr. Duesbury). After a brief interval, the party was conveyed in carriages provided by the President, through Derby, Duffield, and Belper to the Royal Hotel, Matlock Bath, where the formal business of the meeting was to be transacted.

On Mr. Taylor taking the chair, Mr. J. S. Reeves, of Bilston (the Honorary Secretary), read the minutes of the last meeting; and subsequently the following gentlemen were elected members of the Association:—Mr. Frederick Armitage, Gas-Works, Market Harborough; Mr. James Brooks, Gas Engineer, Midland Railway, Derby; and Mr. F. W. Stevenson, Engineer of the Sheffield United Gas Company. There was only time to read one of the two papers named in the programme—viz., that by Mr. J. Ferguson Bell, of Stafford, on "Water Gas." The first portion only of this paper appears in the JOURNAL to-day—there not having been sufficient time for the preparation of the necessary diagrams to illustrate the latter half. The other paper, entitled "Some of the Causes of Unaccounted-for Gas," by Mr. W. T. Tew, of Warwick (given to-day on page 950), was taken as read; and, with Mr. Bell's paper, will be discussed at the autumn meeting of the Association. A vote of thanks having been passed to Mr. Bell for the trouble he had taken in the preparation of his paper, the meeting was brought to a close; and the members afterwards, at the invitation of the President, dined together at the Hotel.

The day was exceptionally fine, and a really attractive programme was thus satisfactorily gone through; much gratification being expressed by all those who took part in the proceedings.

WATER GAS.

By J. FERGUSON BELL, of Stafford.

[A Paper read before the Midland Association of Gas Managers, May 16.]

For some time this method of producing gas has been the subject of comment in various newspapers and technical journals. Hence the public interest has been awakened afresh, and water gas companies are being promoted in various parts of the country. Gas being an intangible substance, a certain amount of mystery appears to some extent attached to it; the result being that many statements lately published, as regards the cost of making water gas (which may be true enough if only interpreted aright), are seized upon, erroneous deductions made from these half-stated premises, and comparisons instituted between the present charges for coal gas and the alleged cheapness of water gas. This must be my apology, if any such is required, for bringing the subject of water gas before a meeting of gas engineers who are exclusively employed in the manufacture of coal gas.

It is now nearly a century since water gas was first produced, and during this period upwards of 100 patents have been taken out in America alone for the production of this gas; one fact being particularly noticeable—that the patents of the present day are almost identical with those brought out years ago. Thus, any company or syndicate professing to hold the original patents for the manufacture of water gas must, I presume, be interested in the possession of antiquarian documents, for they cannot possibly be of any practical value. However much time, energy, and skill have been brought to bear on this method of gas making, especially in America, where a number of water gas companies exist, the comparative prevalence of water gas in America is, no doubt, accounted for in some measure by the fact of anthracite being cheaper and more easily obtained in a large number of places than bituminous coal. From a list kindly supplied by a friend in New York, I find that coal gas is universally sold cheaper than carburetted water gas. Taking a large number of companies supplying coal gas, the average price is about 9s. 6d. per 1000 cubic feet; while taking a number of companies supplying water gas, the average price is 10s. 6d. per 1000 cubic feet. When we remember that in America they have plenty of anthracite coal well adapted for making water gas, and an abundance of cheap oil suitable for carburetting it, and yet they cannot sell it cheaper than coal gas, we can at once see that carburetted water gas cannot possibly compete in England with coal gas, which is sold at one-third the price charged in America, even supposing they are equally suitable for domestic lighting, which is certainly not the case. I believe there are in America upwards of

1000 companies who make coal gas, and about 150 who supply water gas; and the latter are gradually decreasing. It is thus evident that the manufacture of water gas there, in competition with coal gas, is not a very formidable rival. So much, then, for the threatened substitution of carburetted water gas in lieu of coal gas. But a mixture of both may in the future become a reality, especially if anything like panic prices should ever be charged for gas coal.

I will now turn to the theory of the production of water gas, which, as its name implies, is made from water first vaporized and then passed through incandescent carbon, whereby it is resolved into hydrogen and carbonic acid. The latter, as it passes through the fuel, takes up another atom of carbon, thus converting it into carbonic oxide; and if the reaction is theoretically perfect, we should have in the first instance 33 per cent. of carbonic acid and 66 per cent. of hydrogen by volume, and finally 50 per cent. of carbonic oxide and 50 per cent. of hydrogen. I need hardly mention that practically it is impossible to get this theoretical result; and the composition of an average sample of water gas by volume is as follows:—H_2, 48 per cent.; CO, 41 per cent.; CO_2, 6 per cent.; and N_2, 5 per cent.; or 89 per cent. of combustible gases, as compared with 96¼ per cent. of combustible gases in ordinary 17-candle coal gas, the constituents of which are given in Table A. I may here mention that the important results are set forth in the form of tables, so as to enable you easily to verify my calculations, and criticize me if you find they are inaccurate, or that I have not drawn impartial deductions therefrom. The figures in Table B, representing the constituents of water gas, are lower than those generally given by water gas companies; but I think, in practice, these figures will be found correct, even where the most modern water-gas plant is at work, and skill exercised in the working of the same. A high temperature must be produced

TABLE A.—*Constituents by Volume and Weight of Ordinary 17-Candle Power Coal Gas; also its Calorific Value, &c.*

Constituents of Coal Gas.	Vol. Per Cent.	Weight of Gases at 60° Fahr. and 30 in. Bar.	Weight of Constituents of Coal Gas.	Heat of Combustion of Gases per lb.	Calorific Value of Coal Gas.	Oxygen required for Combustion.	Products of Combustion.		
	Cub. Ft.	1 c. ft. = lb.	lbs.	B. T. U.	B. T. U.	Cub. Ft.	OH_2	CO_2	N_2
Hydrogen (H_2)	49·00	0·00531	0·261	61,500	16,051	24·5	49	—	94
Marsh gas (CH_4)	37·00	0·04246	1·571	24,020	37,735	74·0	74	37·0	284
Benzene (C_6H_6)	1·30	0·20700	0·269	18,600	11,821	31·0	13	16·5	117
Propylene (C_3H_6)	1·20	0·11150	0·134	21,200					
Ethylene (C_2H_4)	2·50	0·07420	0·185	21,500					
Carbonic oxide (CO)	5·25	0·07430	0·390	4,400	1,716	2·5	—	5·0	10
Nitrogen (N_2)	3·25	0·07430	0·242	—	—	—	—	—	8
Carbonic acid (CO_2)	0·50	0·10083	0·051	—	—	—	—	0·5	—
Oxygen, &c. (O_2)									
	100·00	—	3·103	—	67,323	132·0	136	59·0	508

Calorific value of 1 cubic foot of coal gas = 673 B. T. U.

Weights of gases after combustion—
OH_2 . . . . $136 \times 0{\cdot}0478 = 6{\cdot}501$ lbs. CO_2 . . . . $59 \times 0{\cdot}1167 = 6{\cdot}885$ lbs. N_2 . . . . $508 \times 0{\cdot}0743 = 37{\cdot}744$ lbs.

Temperature of resultant gases after combustion, if the exact quantity of air required is supplied . . . } t = Heat disengaged − Heat absorbed in maintaining OH_2 in gaseous state.
Σ = (Weight of constituents × specific heats).

$$\therefore t = \frac{67{,}323 - 7398}{(6{\cdot}501 \times 0{\cdot}712) + (6{\cdot}885 \times 0{\cdot}301) + (37{\cdot}744 \times 0{\cdot}222)} = \frac{59{,}935}{15{\cdot}08} = 3970° \text{ Fahr.}$$

TABLE B.—*Constituents by Volume and Weight of Water Gas made from Coke; also its Calorific Value, &c.*

Constituents of Water Gas.	Vol. Per Cent.	Weight of Gases at 60° Fahr. and 30 in. Bar.	Weight of Constituents of Water Gas.	Heat of Combustion of Gases per lb.	Calorific Value of Water Gas.	Oxygen required for Combustion.	Products of Combustion in Cubic Feet.		
	Cub. Ft.	1 c. ft. = lb.	lbs.	B. T. U.	B. T. U.	Cub. Ft.	OH_2	CO_2	N_2
Hydrogen (H_2)	48·00	0·00531	0·255	61,500	15,682	24·0	48	—	90
Carbonic oxide (CO)	41·00	0·07430	3·046	4,400	13,402	20·5	—	41	78
Carbonic acid (CO_2)	6·00	0·11682	0·701	—	—	—	—	6	—
Nitrogen, &c. (N_2)	5·00	0·07430	0·372	—	—	—	—	—	5
	100·00	—	4·374	—	29,084	44·5	48	47	173

Calorific value of 1 cubic foot of water gas = 291 B. T. U.

Weights of gases after combustion—
OH_2 . . . . $48 \times 0{\cdot}0478 = 2{\cdot}294$ lbs. CO_2 . . . . $47 \times 0{\cdot}1167 = 5{\cdot}485$ lbs. N_2 . . . . $173 \times 0{\cdot}0743 = 12{\cdot}854$ lbs.

Temperature of resultant gases after combustion, if the exact quantity of air required is supplied . . . } $= \frac{29{,}084 - 2546}{(2{\cdot}294 \times 0{\cdot}712) + (5{\cdot}485 \times 0{\cdot}301) + (12{\cdot}854 \times 0{\cdot}222)} = \frac{26{,}538}{6{\cdot}137} = 4320°$ Fahr.

TABLE C.—*Constituents by Volume and Weight of Gases Produced when Air is Blown into Generator, called "Producer Generator Gas."*

Constituents of Producer Generator Gases.	Vol. Per Cent.	Weight of Gases at 60° Fahr. and 30 in. Bar.	Weight of Constituents of Producer Gas.	Heat of Combustion of Gases per lb.	Calorific Value of Producer Generator Gas.	Oxygen required for Combustion.	Products of Combustion in Cubic Feet.		
	Cub. Ft.	1 c. ft. = lb.	lbs.	B. T. U.	B. T. U.	Cub. Ft.	OH_2	CO_2	N_2
Hydrogen (H_2)	2·00	0·00531	0·0106	61,500	652	1	2	—	4
Carbonic oxide (CO)	20·00	0·07430	1·4860	4,400	6,538	10	—	20	38
Carbonic acid (CO_2)	3·00	0·11682	0·3505	—	—	—	—	3	—
Nitrogen, &c. (N_2)	75·00	0·07430	5·5725	—	—	—	—	—	75
	100·00	—	7·4196	—	7,290	11	2	23	117

Calorific value of 1 cubic foot of producer generator gas = 73 B. T. U.

Weights of gases after combustion—
OH_2 . . . . $2 \times 0{\cdot}0478 = 0{\cdot}096$ lbs. CO_2 . . . . $23 \times 0{\cdot}1167 = 2{\cdot}684$ lbs. N_2 . . . . $117 \times 0{\cdot}0743 = 8{\cdot}693$ lbs.

Temperature of resultant gases after combustion, if the exact quantity of air required is supplied . . . } $= \frac{7290 - 106}{(0{\cdot}096 \times 0{\cdot}61) + (2{\cdot}684 \times 0{\cdot}27) + (8{\cdot}693 \times 0{\cdot}21)} = \frac{7184}{3135} = 2290°$ Fahr.

TABLE D.—*Constituents, Calorific Value, &c., of Various Gases.*

Name of Gas.	Composition by Volume per Cent. in Cubic Feet.						Weight of 100 Cub. Ft.	Combustible Gases by Volume.	Calorific Value per Cubic Foot.	Air required for Combustion per Cubic Foot.
	H_2	CH_4	C_2H_4 &c.	CO	CO_2 &c	N_2	lbs.	Per Cent.	B. T. U.	Cub. Ft.
Coal gas	49	37	5	5½	0½	3½	3·103	96·25	673	6·37
Water gas	48	—	—	41	5	6	4·374	89·00	291	2·13
Producer gas	9	2	—	25	5	59	6·959	41·00	132	1·01
Producer water gas	2	—	—	20	3	75	7·420	22·00	73	0·53

to decompose the steam—the conversion being most perfect when the temperature is about 2000° Fahr., which, as we can readily understand, will not be long maintained; for, as the steam is decomposed, the temperature of the producer is being constantly lowered. Hence, towards the end of the period during which water gas is being made, carbonic acid will be produced in quantities varying according to the efficiency of the apparatus; also inert nitrogen will be present, for a certain residue is left in the producer each time after heating up by means of the air-blast prior to making this gas.

It may be interesting to calculate approximately the volume of water gas obtainable from a ton of average quality gas coke, supposing the gas produced is of the composition and thermal value given in Table B. We may take the total heat obtainable from 1 lb. of coke on perfect combustion at 12,800 B.T.U.; and water gas, according to the table referred to, has a calorific value of 291 units per cubic foot. Now, this gas leaves the generator at not less than 1800° Fahr., and will require to be cooled to 60° previous to being passed into the holder. Thus we have $(1800-60)\times 1{\cdot}827$ specific heat $\times$ 0·0277, the weight of one cubic foot in pounds. These give 87 units of heat lost per cubic foot of gas made; and if we divide the units of heat contained in 1 lb. of coke by the thermal value of one cubic foot of water gas *plus* the heat dissipated in cooling the gas, we have $\frac{12,800}{291+87}$ or 33·86 cubic feet of gas per pound of coke, which is nearly 76,000 cubic feet per ton, supposing it were possible to transfer the whole calorific value of the coke into water gas, which is, of course, physically impossible.

We find 100 cubic feet of water gas weigh 4·374 lbs. Hence 33·86 cubic feet will weigh 1·48 lbs., and of this 0·76 lb. is oxygen. But to obtain 12,000 B.T.U. per pound of coke, we require for complete combustion 2·36 lbs. of oxygen; and thus 1·60 lbs. more oxygen is required than the water gas contains. If I have made myself clear, it will be evident that this is the quantity which must be supplied by means of the air-blast, so that the carbon contained in the coke can be perfectly oxidized. We have therefore $(76,000 \times 0{\cdot}76) \div 2{\cdot}36$, which equals 24,500 cubic feet as the quantity of water gas that can be produced from a ton of gas coke. If we allow 6 per cent for loss by radiation, cleaning out the generator, imperfectly burnt fuel, &c., we shall be well within the mark. This, then, makes 23,000 cubic feet as the total available quantity of water gas that can be made, under the most favourable conditions; for 12,800 B.T.U. per pound of fuel is a fairly high calorific value for ordinary gas coke. By a similar calculation, when using best anthracite coal containing a low percentage of ash and sulphur, also the high calorific value of 15,200 B.T.U. per pound of coal, we obtain 31,500 cubic feet of gas per ton, which does not widely differ from the figures given by water gas companies. The difference in the quantity of gas produced when using gas coke and best anthracite coal is of importance, and will require to be taken into account when comparing the cost of producing water gas *versus* coal gas.

When making water gas, a large quantity of hot gases are produced, which, besides being at a high temperature, contain about 20 per cent. of carbonic oxide, and these have lately been honoured with the name of "producer gas," though the composition and fuel value of producer gases proper are very different, as given in Table D, which shows at a glance the constituents and calorific values of the various gases named. I have called the gases made when blowing up the producer, prior to making water gas, "producer water gases," so as to distinguish them from producer gas proper. If these gases are conveyed by means of brick flues, so as to retain the sensible heat, they may be utilized to evaporate water, &c.; therefore no additional charges need be added for fuel required for raising steam when making water gas. But it must be borne in mind that the cost for fuel to produce the necessary steam is a comparatively small item; and hence in most of the American water-gas plants these hot gases are allowed to escape into the atmosphere after heating up the fixing chamber. Producer water gas cannot possibly be of much value, for it consists principally of inert nitrogen; and, if allowed to cool, would be of little or no practical use, unless employed in regenerative furnaces, or mixed with gas of greater heating power. However, in a few instances it might be used for raising steam—as in large works, where volume is required of low intensity. For each cubic foot of oxygen supplied by the air-blast, we have upwards of 4 cubic feet of inert nitrogen; and thus these gases must contain about 70 per cent. of nitrogen, besides a varying percentage of carbonic acid; and when the sensible heat is removed, their calorific value, according to Table C, is only 75 B.T.U. per cubic foot, or about one-fourth the heating power of water gas, and one-ninth the thermal value of coal gas.

Before passing from the theoretical to the practical, I will briefly indicate the relative temperatures of coal, water, and producer water gases, which are calculated from the formula—

$$t^\circ = \frac{\text{Heat disengaged} - \text{Heat absorbed by } H_2O.}{\Sigma\,(\text{weight of constituents} \times \text{specific heat})}$$

attention being drawn to the fact that it is now known, from MM. Mallard and Le Chatelier's recent experiments, that the specific heats of combustible gases increase with the temperature. The intensity of the heat produced by combustion is most important; for fuel gas may have a fair calorific value, but be totally unsuitable for the work on account of its low temperature of combustion. Inert gases not only lower the temperature, but retard the combustion. Thus, as already noted, when the sensible heat of producer gases is removed, they are of themselves of little practical use, on account of the large percentage of inert nitrogen present, which reduces the temperature, making ignition difficult, and causing great liability to sudden extinction by air currents.

In Table A you will notice that the temperature of combustion of ordinary coal gas, when the exact quantity of air required is supplied, is 3970° Fahr., which is quite high enough for most purposes in the arts and manufactures; and if along with this you take into account the high calorific value of coal gas—*i.e.*, 673 B.T.U. per cubic foot—it must be conceded that this is a most valuable fuel, available either for motive power, heating, or lighting purposes. Now, as regards water gas, the temperature of combustion according to Table B is 4320°, which is somewhat higher than that of coal gas; but it only contains 291 B.T.U. per cubic foot, as against 673 B.T.U. in coal gas. You must therefore use more than twice the quantity of water gas to do the same amount of work as coal gas, which is an important matter when comparing the relative values of these gases. For example, it takes 25 cubic feet per indicated horse power per hour to work a gas-engine by means of coal gas, but it would take 56 cubic feet of water gas; and the same practically applies when these gases are used for heating purposes.

It has been frequently suggested that gas companies should supply a cheap fuel gas, consisting of a mixture of coal, water, and producer gases. Well, in a few isolated cases, where large users of fuel gas are in close proximity, such a dual system might be a commercial success; but it should be noted that this means separate mains of large capacity. The following would be the approximate yield of mixed gases for each ton of gas coal, supposing the gas is first extracted in closed retorts, and the coke afterwards gasified into water and producer water gases:—

	Cub. Ft.		Heat Units		B. T. U.
Coal gas	10,000	×	673	=	6,730,000
Water gas	12,000	×	291	=	3,492,000
Producer water gas . . .	42,000	×	72	=	3,066,000
					13,288,000

$$\therefore \frac{13,288,000}{64,000} = 208 \text{ B.T.U. per cubic foot of mixed gases.}$$

This mixture is much superior to ordinary producer gas, which is a weak and bulky fuel. But I am afraid the demand in the majority of places would not be sufficient to make such a duplicate system a success; for where large quantities of fuel gas of low intensity are required, generator or producer gases can be made cheaply on the premises, and a supply of coal gas taken where high calorific power and intensity are needed. Again, the cooling of so large a volume as 42,000 cubic feet of producer water gas per ton of coal from 1800° to 60° Fahr. means a loss of nearly one-half the total calorific value of this gas; in other words, dissipating the sensible heat of these gases means a loss of more than 3,000,000 heat-units, or 10 per cent. of the total heating value of the coal. This plainly indicates to my mind that producer gas cannot be delivered economically from a central station; for these gases should be used with as little loss of sensible heat as possible. Unlike coal gas, they are bulky and weak; thus the loss of their sensible heat is a serious item.

[The concluding portion of the paper, in which the various forms of water-gas plant are described and illustrated, will be given next week.]

SOME OF THE CAUSES OF UNACCOUNTED-FOR GAS.

By W. T. Tew, of Warwick.

[A Paper presented to the Midland Association of Gas Managers, May 16.]

For a long time it had been my impression that the influences of temperature and pressure had a considerable effect upon the quantity of gas which is usually called "unaccounted-for" or "leakage;" and it was with the idea of ascertaining to what extent this influence prevailed, that the present paper was prepared. At the outset, I may say that I am somewhat disappointed at not finding a greater difference than is apparent; but inasmuch as small matters are not to be despised, I take the liberty of placing my ideas on these points before you.

It is well known that heat exerts a great influence on gaseous bodies, causing them to expand at an uniform rate of $\frac{1}{480}$ of their bulk for each degree Fahrenheit; and it was in making the usual corrections for temperature and barometrical pressure, that my attention was called to the possibility of the difference between gas made and gas sold being to some extent caused by the variations of temperature.

The temperature of the gas at the outlet of the station meter at my own works varies from 40° in sharp weather in the winter, to 68° or 70° during very hot weather. It has never been below 40° for some years; but generally during a moderate winter the temperature is from 45° to 50°, the proximity of the purifiers to the meter being, as I think, one reason for the temperature of the gas being high. As the greatest consumption of gas goes on at the time when cold weather prevails, it is evident that, should the consumers' meters be kept at a lower temperature than the station meter, the result must be that they would receive more gas to the cubic foot than was registered at the works. I regret that no opportunity has occurred of testing the temperature of the consumers' meters; but judging from the number which fall below 32° during a sharp frost, there is reason for assuming that a considerable proportion both of wet and dry meters are kept many degrees below the temperature which is maintained in the station meter. And when it is considered that a fall in the temperature

of 5° at the consumers' meters involves a loss of approximately 1 per cent. of the quantity measured, and that in many cases the actual difference in severe weather is perhaps 10°, and that whilst this cold weather prevails the maximum consumption is going on under these adverse conditions, we are justified in assuming that an important factor in the calculation of unaccounted-for gas is to be found in the coldness of consumers' meters.

In justification of this view, let us consider the conditions under which meters are usually fixed. If a dry meter is the one to be put in, the practice is to put it anywhere out of the way. We are told that dry meters "won't freeze, you know;" and so if it is an open passage exposed to the direct influence of the N.E. wind, it does not matter, nothing will be affected by the situation. The meter will not stop working; but in such cases the consumer has the obvious advantage over the supplier of gas, as, for every foot of gas he consumes, the producer has to account for so much more that the difference in the temperature calls for. But should the meter be a wet one, a little more care has to be exercised. It will freeze, and therefore must be placed in a warmer corner; and inasmuch as a fall has to be made from the pipes in the house, the favourite spot for the wet meter is known to be the cellar. Here as a rule the temperature is more regular than in a situation where a dry meter can be fixed with safety; but at best cellars are cold places; and I have no hesitation in asserting, as far as my experience goes, that most of the situations in cellars are at a lower temperature than the meter-house at the works. I have also in my mind some important wet meters for the supply of public institutions which are fixed in small rooms specially erected for the purpose. During the winter the greatest care is necessary to prevent freezing; and the temperature is kept barely above 32°, whilst the gas at the works is being measured at 42°—entailing a loss of about 2 per cent. on the quantity supplied, and this to large consumers at the period of maximum consumption.

I may be reminded, as a set-off against this, that some meters are fixed in really warm places, where the conditions are such that a more favourable registration is induced. In the case of dry meters so situated, there is, no doubt, an allowance to be made; but when wet meters are so placed, the evaporation is increased so rapidly that the expansion in volume of the gas is counteracted by the lowness of the water-line. Indeed, during the summer the large meters, about which I spoke before, require weekly attention to keep their water-line near the proper place. So that, taken with the fact that this occurs at the period of minimum consumption, it will not, in my opinion, do much towards reducing the loss caused by the effect of the colder weather.

The irregular consumption of public lamps is also a source of loss, as 0·1 cubic foot consumed in excess of 5 cubic feet per hour, should this quantity be stipulated, results in a loss of 2 per cent. on the quantity consumed.

Some time ago, when in conversation with Mr. Cross, of Leamington, on this subject, he mentioned the pressure of heavy holders as having a bearing upon this matter; and, after an investigation, I arrived at the following results:—The pressure of a gas-holder is equal, we will say, to 6 inches of water. This acts on the station meter with a pressure of 0·2171 lb. per square inch; being equal to an additional ¼ inch barometrical pressure. So that in using the table provided in various handbooks for correction for barometrical pressure and temperature, it is only necessary to add to the figures used for correction the sum of 0·017, and the adjustment for 6 inches pressure will be obtained. For example, supposing the holder contained 100,000 cubic feet of gas, at 30 in. Bar., and 60° Fahr. (this being the standard condition of pressure and heat), the multiplier for correction would be 1. By adding 0·017 to this, and multiplying the 100,000 cubic feet, we have 101,700 as the actual quantity of gas in the holder, if relieved from all pressure; being 1½ per cent. more than that registered in the station meter. Following this to its logical conclusion, we find that the leakage account should, in works where heavy gasholder pressure is used, be reduced to a low point, at the sacrifice of a certain quantity of gas per ton of coals used. It will be interesting to know if such is the case. If this inference is correct, large works should be more favourably situated than smaller ones, as respects loss by leakage, while making less gas per ton of coal.

The conclusions at which I think we may fairly arrive are that, under circumstances where the station meter is kept at a comparatively high temperature, the difference in the temperature of the consumer's and the station meter is a cause of an apparent loss of gas; and in cases where a low leakage account is the rule, accompanied by heavy gasholder pressure on the station meter, it is a question whether the former is not caused by the latter.

I have purposely refrained from making any remarks respecting actual leakage from defective mains, &c., not from ignorance of their importance, or of their much greater significance than the obscure causes at which I have hinted, but because I wished to confine your attention to those conditions which, as a rule, are not taken, and cannot be taken into account when making up the returns for gas sales, but which, I trust, you will acknowledge exercise no inconsiderable influence on the mysterious leakage account, and will apparently dispel the hope of ever being able to account for the whole of the gas manufactured.

The Directors of the British Water Gas Syndicate, Limited, have notified theiri ntention of not calling up the final £2 per share due on the 3rd prox.; and a scheme for the reduction of the capital is to be submitted to the shareholders.

VENTILATION BY GAS.

By J. F. Simmance.

[A Paper read at the Royal Institution, Liverpool.]

It is difficult, in a paper like this, to avoid going over ground already familiar to you; as probably ventilation, as a science, has been studied as much as most subjects. But ventilation in connection with gas lighting, although in itself pretty old (having been first introduced by the late Mr. J. O. N. Rutter, of the Brighton Gas Company, in 1833), is, as a study, comparatively new to most persons. Naturally, its fundamental principle, of producing a movement in the atmosphere by effecting a difference in specific gravity by expansion, is taught at all elementary schools; but a practical application of it to combine artificial illumination with sanitation, and thus to utilize the heat-giving properties of coal gas in a way calculated to turn them into distinct advantages, is, I think, little known. In fact, I may go so far as to say that ventilation itself is not well understood, in spite of the attention which has been given to it. For instance, in a neighbouring Town Hall (a new building), a few nights since, during a dramatic performance, some of the star lights were extinguished by accident, and being turned on again unlighted, we in the auditorium could distinctly perceive the odour of the escaping gas, although we were 30 feet below the burners, and this in spite of the most modern ventilating appliances fixed in the roof. Again, nearer home, in one of our public buildings, an escape of gas at the top of the room, immediately beneath a range of 24-inch mechanical ventilators, can be detected at once by anyone in the room. This is not ventilation; but I have no hesitation in saying that, with a properly arranged system, all gas would, under the circumstances, pass away unperceived. In a properly ventilated room, you should be able to smoke a cigar through to the end, and yet a person coming in a few minutes after should not be able to detect any odour, The air should be constantly changing, as water in an aquarium is constantly renewed. Certain exhalations from the lungs should be removed, and a requisite supply of air, in such quantities as to make such impurities removeable, should be admitted. It should be noticed that no more inlet and outlet is required per person in a small room than in a large one; and the provisions of the Medical Boards, that every hospital patient should have a certain number of cubical feet of space in the room is, to my mind, a tacit confession that the ventilation is not to be relied on, and that in consequence it is necessary to make such provision that patients shall not be *quickly* inconvenienced. What is the first thing done in the morning? To open windows, &c., to dilute the accumulated and stagnant impurities of the night. And the provision of a great cubical area per inmate is simply a precaution in the way of diluting the impurities as much as possible. I must, of course, admit the beneficial effects of large areas, as they have the very good result of maintaining a more equal temperature by lessening the effect of wall radiation, which would soon make a small apartment uncomfortably warm, ventilation or no ventilation. But a man should exist as healthily, so far as his breathing apparatus is concerned, in a cell just large enough for his body, as in a cathedral, provided he is not required to breathe the same air twice.

I have, in the first place, to point out that a combination of gas lighting and ventilation is the cheapest and most efficient method of effecting the best results in each. There are, roughly speaking, four methods of ventilation—(1) diffusion, (2) specific gravity, (3) vacuum caused by the action of wind on cowls, and (4) fans driven by mechanical power. You will say at once that the two first and the two last are identical. They are, practically; but I prefer dividing them thus.

The diffusion method of ventilation is the way in which most living-rooms are ventilated. The diffusion between the warmed interior and the fresher air outside takes place gradually through plaster, bricks, &c. The chimney also draws in its supply from the windows and doors, which supply comes straight across to the fire, leaving the top stratum of heated products almost untouched except by diffusion. Even with a large fire in a room, the air close to the ceiling is generally unbearable. But it must not be forgotten that a good deal of the heat there is heat radiated from the ceiling, and is not heated products. In many cases air-bricks are let into the outer walls of rooms, high up, presumably to allow the heat to escape; but then real ventilation is generally set up unintentionally, as these all act as inlets, and the air current cools down the hot products in its passage through them to the fire, and probably brings them within the range of the chimney's attraction or vortex. The obvious objection to this is the cold draught upon the heads of the persons in the room. A distinct case of this sort of ventilation can be experienced near Liverpool, where the architect—a man of much eminence—has, in dealing with a room some 35 feet by 25 feet, inserted two ventilators, each of about 12-inch capacity, in the ceiling, and carried them out at the ridge; there are also 10-inch by 5-inch inlets arranged round the room. With such an array, one would expect good results; but, unfortunately, there is a large fireplace at one end of the room, and the heat evolved by the combustion of about ¼ cwt. of coal at the base of a chimney-shaft running up level with the ventilators entirely upset matters. Instead of the chimney drawing its supply of air from the inlets placed so invitingly in the walls, it is capricious enough to prefer getting in at the 12-inch grid in the ceiling. The room is ventilated; but, standing in a familiar attitude before the fire, the draught upon one's head is excruciating. In fact, the coldest place and time

before the fire when one's clothes are scorching. All this naturally alters when the doors or windows are opened.

The second method of ventilation is by specific gravity, or artificially increasing the difference in temperature between the air to be removed and that to be inducted. In the case of the fire draught that also is by specific gravity; but, as I have said, I prefer classing them separately.

I now come to mechanical cowls, ventilators, &c.; and I must say at once that I have had very little experience with these, but evidently their extracting power varies as wind-force varies. Fans driven by power are not common except in mines, tunnels, &c., and it does not seem necessary to go into that subject.

Now, the point of this enumeration of these different systems is as follows:—In the case of diffusion, as the quality of our bricks and plaster varies, and the fitting of our windows and doors approaches perfection, and as we have a big or a small fire, so will the effect upon the room vary. It is not a reliable system of ventilation, nor can it be put down, even approximately, in figures. With a mechanical or air-pump cowl, the wind-force varies; and with a cold, still atmosphere it appears to me that the heavy cold column of dense air in the vertical flue would drop straight down as a shower bath, should a slight warmth be generated in the room below. Again, it appears to me that ventilation so obtained is not a constant quantity. With a mechanical fan, the quantity is constant, but for ordinary use it is out of the question. I am informed that at our Town Hall a fan is driven by a gas-engine, and acts perfectly. Naturally it does; but to use one set of gas apparatus for lighting and another for ventilation is like having one fire for warming a room and another to induce a draught up the chimney. But by utilizing the heat of the gas lights for ventilating by specific gravity, the amount of output is entirely under control—it is practically unaffected by extraneous circumstances. A certain heat is produced by the combustion of a given quantity of gas. The area and height of the ventilating shafting is arranged in accordance with actual requirements and known rules; and although these rules point out that small variations must occur, the range of these variations is so easily calculated that, as I have said, this system of induced draught is practically unaffected by any uncontrollable circumstances. Thus in certainty and efficiency we can only compare ventilation by gas lighting with mechanically worked fans; and when we look upon them from an economical point of view, the fact that one lights and ventilates at one and the same time, places it at once in a position of superiority.

Now, before going into the more technical part of our subject, I should mention electricity as a lighting agent. I do not for one moment presume to say a word as to its future; but, perhaps, on consideration, you will agree with me that a lighting system which admits of its combination with sanitation is likely to maintain a foremost place. The absence of heat, which has been unthinkingly indicated as the great advantage of the electric light, is undoubtedly its very great disadvantage; as, in addition to the cost of lighting, some other system of inducing a movement in the atmosphere of apartments must be adopted. When the actual advantages which a hot light possesses are fully grasped by architects, a more severe blow will be dealt at indoor electric lighting than any it has yet received by the development of gas lighting.

Having now laid before you my reasons for believing the subject of my paper to be worthy of careful consideration, I will proceed to place before you a few elementary particulars as to methods of arriving at a proper basis for the construction or ordering of gas ventilating apparatus, of descriptions suitable for any sized apartment. Naturally, the number of persons in the room, the quantity of light required, &c., cause this apparatus to require modification under various circumstances; but the simple formulæ I propose to mention are, I think, of such a nature as to admit of any person, whether architect or not, working out a scheme of ventilation for his own large or small rooms.

The data upon which we must base our calculations are—

1. The light required for adequate illumination.
2. The amount of gas required for producing that light.
3. The seating space of the room (number of inmates).
4. Air required to supply (*a*) the lungs of the persons present, and (*b*) the gas-lights.
5. The temperature of exhalations from the persons present and of the products of gas combustion.

It will be seen that if we have all this information, we shall know the amount of air required by means of inlets and the quantity for which we must provide exit. The former may be left to itself so long as it is in excess, as naturally it is the outlet which governs the inlet.

Now we come to the information required for estimating these outlets—

6. The length of the upcast shaft.
7. The temperature of the external atmosphere.
8. The temperature of the mixture of products of combustion and vitiated air at the base of the upcast shaft.

The question of this upcast shaft I will deal with later. For real induced extraction, a vertical, or at least a rising shaft is a necessity, if the outlets are to be kept of a reasonable size, as the addition of a tube 12 inches square, 10 feet long, to a 12-inch aperture in a roof would treble the output, with a difference of 25° between the two atmospheres.

The methods of estimating the various points I have enumerated are as follows:—

The light required for adequate illumination varies, of course, for rooms for different purposes; but I shall take as a fair average that the light at the ends of the room shall be equal to that given by one standard spermaceti candle (six to the pound), burning at the rate of 120 grains per hour, held at a distance of 2 feet from the wall or surface to be lighted. This is equal to 0·25 candle, as you know that light decreases in inverse ratio to the square of the distance. So we get

$$CD^2 = \text{Illuminating power of light required;}$$

D being the distance from the proposed position of the light, and C the amount of light required upon the wall or table.

I may say that 1-10th of a candle, held at rather more than 3 feet from the wall, is a fairly good light; but anyone with a standard candle can judge for himself the light required and calculate accordingly.

Having now the means of ascertaining the power of light required, we pass on to the amount of gas required to give that light. Naturally, this varies with the quality of the gas in the town; and in a greater degree upon the style of light used. Liverpool gas, burnt at the rate of 5 cubic feet per hour in a standard batswing burner, gives a light equal to about 21 standard candles, and is thus called 21-candle gas. We will base our calculations upon this.

We now proceed to discuss the kinds of ventilating lights; and I think we may take these as three in number—

1. A well-governed cluster of flat flames, burning from non-corrodible steatite burners.
2. A compound Argand.
3. A type of lamp called (I do not know why) a regenerative lamp.

You observe that I do not mention the sun-burner, with little stars of flames projecting horizontally, which, although used largely in theatres, is too unscientific and extravagant to be extensively employed in the future. One removed from the Bank of England in London and tested in a photometer gave the magnificent result of 1 candle per foot of gas burnt. As all the three systems I mention yield upwards of 7 candles per foot, I think we need not consider the old-fashioned system.

The cluster of flat flames gives an illuminating power, when in a properly arranged sun-burner, of about seven candles per foot. Its advantage is the absence of any glass which might require cleaning, and the brilliantly warm tone of light it throws. The compound Argand is a series of concentric rings of steatite with well-arranged air supplies, and a flash or pilot light in the centre for burning constantly. The glass chimney is short, and not liable to break. One going in my own office here has been alight night and day for more than twelve months, and the original chimney is still intact, and I expect it to last for years. This type of light gives over 8 candles per foot. The so-called "regenerative" lamp is an arrangement by which the heating of the flame is facilitated. Large quantities of oxygen—the maximum amount, in fact—can be brought into the flame without impairing its steadiness. Also arrangements are made for preventing a cooling down of the flame by cold currents. This light (fitted with opal reflector) gives the highest result known—viz., an effective downward light of 18 candles per cubic foot of gas.

We can now estimate the quantity of gas required for producing the amount of light we have found requisite—

$$\frac{I}{d} = \text{gas per hour.}$$

As to the number of persons likely to be in the room at one time, this will be a fixed quantity, and must be taken as the maximum seating capacity.

We now come to the amount of air required for (*a*) the lungs of the people and (*b*) gas combustion. An adult breathes about fifteen times a minute; each respiration being about 30 cubic inches of air, which should contain one-fifth oxygen. The air we breathe appears to be nearly alike in composition everywhere, and contains traces of sulphuretted hydrogen, ammonia, &c., but is practically a mixture of carbonic acid, oxygen, and nitrogen. The carbonic acid exists in only about 5 to 10,000 volumes. On respiring the air a change takes place, both in the blood itself and in the air. With the former we have nothing to do. The air is increased in temperature, being at its expulsion at the temperature of the lungs themselves, and only varying a few degrees according to the time it remains in them. The carbonic acid of the air is increased and its oxygen diminished in nearly the same ratio. We thus see that each respiration or expiration is the means of removing a certain proportion of carbon from the lungs. It is also proved (if I remember rightly, by Allan and Pepys) that after being charged by re-respiration with 10 per cent. of carbonic acid, it would not take up any more, even if breathed over and over again until life was extinct. From every volume of air about 4½ per cent. of oxygen is changed by its combination in carbonic acid, and rather less than 4 per cent. of carbonic acid takes its place. This is only an approximate amount, as the quantity of carbonic acid in respired air varies very much under different circumstances. There are some peculiar features about this. For instance, women exhale less carbonic acid than men of the same age, with whom it increases gradually up to forty years of age; and then, after remaining stationary for a time, diminishes. In the case of women, it is stationary for a large part of their lives. Then external temperature varies the amount of carbonic acid exhaled; as within 38° and 75° Fahr. every 10° rise diminishes by 2 cubic inches per minute the carbonic acid exhaled.

Also more carbonic acid leaves our lungs in spring than at any other time; more also when the atmosphere is moist than when it is dry; more when food is consumed than when we fast; more when farinaceous is used in larger quantities than animal food. A fair average is 1346 cubic inches per hour, or 8 oz. of solid carbon in 24 hours. Now, taking the figures as just stated—that 4½ per cent. of oxygen is abstracted and 4 per cent. of carbonic acid added at each respiration, and also the fact that 10 per cent. of carbonic acid is poisonous, we have in 100 volumes of air, after a first respiration, 4 per cent. of carbonic acid, 7·8 per cent. after the second, and then at once we reach the point where the injurious effect comes in. It will be seen that having 21 per cent. of oxygen in each volume of air, and exhausting this at the rate of 4½ per cent. per respiration, there is still a supply of oxygen, although the limit of healthy breathing has been passed at the third breath. But carbonic acid and water are not the only products from the lungs. Wiederhold has stated that ammonia, chloride of sodium, uric acid, and urate of soda and ammonia may be very readily detected in the condensed vapour of expired air.

I have gone thus into this point to show that, in my opinion, ventilation can only be accomplished by causing a steady upward movement in the atmosphere of a room, and introducing entirely new oxygenating material.

As I have said, an adult requires about 450 cubic inches of air per minute, 27,000 cubic inches or 16 cubic feet per hour. In Molesworth and many other books, 3 or 4 cubic feet per minute is given as a man's requirements; and it looks to me as if they had confused square inches and cubic inches. But, to be certain, I consulted an eminent surgeon, who corroborated these figures of mine, and pointed out to me a list of authorities, unconnected with ventilation, but intimately acquainted with the wants of the human lungs, whose calculations give me ground for my 16 cubic feet per hour. Naturally one would allow a margin, and I propose estimating upon 20 cubic feet per hour.

(To be continued.)

A Water Scheme for Valparaiso.—A scheme is on foot to provide Valparaiso with water. The proposal is to spend $1,300,000 in making at Peñuela an artificial lake of the capacity of about 13,000 million gallons, to be supplied with rain water.

Manchester District Institution of Gas Engineers.—The seventy-eighth quarterly meeting of this Institution will be held next Saturday, when, as is usual at the spring meeting, the day will be devoted to an excursion. According to the programme of arrangements which has been issued by the Honorary Secretary (Mr. S. S. Mellor, of Northwich), the members and their friends will leave the Victoria Station, Manchester, by the ten o'clock train for Settle, where they will have luncheon at the Ashfield Hotel, and afterwards proceed in conveyances to Clapham, in order to visit the celebrated cave in the neighbourhood of the village. The village itself will have a certain interest for the members, inasmuch as it claims the honour of having been the home of the ancestors of Sir Michael Faraday; the father of the illustrious chemist having worked there as a journeyman blacksmith before removing to London in 1790. The cave, like most of those in limestone districts, is rich in masses of stalagmite and beautiful stalactites; and will no doubt prove an attractive object to the visitors, as it does to most tourists. On the return to Settle, tea will be served at the Ashfield Hotel, and the business of the meeting (which will be confined to the confirmation of the minutes of the previous meeting) transacted. Manchester will be again reached about nine, when the day's proceedings will close.

The Late Mr. R. P. Spice.—The funeral of Mr. R. P. Spice, whose rather sudden death, on the 11th inst., was recorded in the last issue of the Journal, was attended by a large number of his private and professional friends. The first portion of the ceremony, which took place last Wednesday, was conducted in the church of St. Margaret's, Westminster, the interment being in Brompton Cemetery. The gas companies with which the deceased gentleman had been professionally associated sent representatives; among whom were Messrs. W. Noakes and R. Pelton (Directors), J. Read (Secretary and General Manager), and A. Dougall (Manager), of the Tunbridge Wells Gas Company, and Mr. Cornelius Prior, Secretary of the Hoddesdon Gas Company. It will be remembered that Mr. Spice's earliest work was in connection with this Company, the Directors of which, at a meeting held on the morning of the funeral, testified their appreciation of his services, and their regret at the loss of them, by passing the following resolution:—"That this Board has heard with great regret of the death of Mr. Spice, and desire to express their sympathy with the bereaved family. They desire also to record the valuable service Mr. Spice rendered to this Company at its formation in 1847, and in the erection of the original works of the Company in that year. Mr. Spice since that date has acted as Consulting Engineer in the various alterations and extensions until the year 1886, when the original works were pulled down, and new works built, much more convenient, near the railway. The plans, &c., were prepared by Mr Spice, and carried out by Messrs. Cutler and Son, under Mr. Spice's superintendence, with all modern improvements. He also greatly assisted in obtaining statutory powers for the Company; the Hoddesdon Gas Order having been obtained in the year 1886. The Directors feel much of the success of the Company, from its commencement, is due to Mr. Spice's valuable services, and the wise counsel he always gave most cheerfully."

Correspondence.

[*We are not responsible for the opinions expressed by Correspondents.*]

GAS STOKERS AND THE EIGHT-HOURS MOVEMENT.

Sir,—Your leading article, in the last issue of the Journal, on the eight-hours movement among gas stokers, contains one statement which was somewhat a surprise to me. You say that you are not aware of any English town in which the eight-hour shift is in vogue. It may therefore be interesting to you and your readers to know that we have had the eight-hour system at Burnley, with very little intermission, for more than fifteen years. Our most usual custom is to burn off the charges in four hours. But we have very often worked six-hour charges; and at present our retorts are being charged at intervals of 4 hrs. 48 min. These changes, however, make no difference to the length of the shift. No doubt the twelve-hour shifts lend themselves very readily to a twelve-hours stoppage on Sunday, as, without such a stoppage, it would be necessary for the men to work eighteen-hour shifts when changing from night to day. It is, however, just as simple to stop one or two shifts on Sunday with the eight-hour system.

It must not be understood that my remarks in favour of the shorter shift have any bearing on the question of wages, as we expect a man to do as much work in an eight-hour shift as in a twelve-hour shift. Given a certain amount of work to be done in 24 hours by six men, we find they prefer to do it by three shifts of two men, rather than by two shifts of three men each. If the adoption of eight-hour shifts means the employment of a larger number of men, it is hardly to be expected that the London Gas Companies will be willing to accede to the demand.

Burnley, May 15, 1889. John P. Leather.

STAPP'S WATER GAS.

Sir,—Everyone must read with great interest the excellent speech of the Chairman of the British Water Gas Company at the statutory meeting of that Company held yesterday [see p. 959]. I must, however, in the interest of the shareholders of my Company, as well as of the public, join issue with him as to his statement that nobody knows how to make cheap water gas with the exception of his Company. My Company's process has been adopted at various towns in America—amongst others, Denver, Georgetown, Leadville, Chicago, Kansas City, and Jacksonsville; and, notwithstanding Mr. Fox's statement, it will shortly be seen at work in England, Scotland, and Ireland.

The value of a company's shares is not always to be judged by the price; nor can a monopoly be secured by the dictum of a Chairman of a public meeting. Doubtless there is a great future for water gas; and those interested will adopt the best and cheapest illuminating process. My Company will endeavour to attain success by practical results and public opinion.

Warine B. M. Lyeley,
Chairman, Stapp's Water-Gas Patents, Limited.

London, May 15, 1889.

WATER GAS MANUFACTURE AND THE PRICE OF COKE.

Sir,—Your correspondent "Gas" has touched a weak point in the present methods of making water gas, by referring to the probable advance it will cause in the price of coke. If the present companies are to get even 5 per cent. on their capital, water gas must be adopted by such a number of firms as will require all the gas coke now produced in their several counties or districts. It will be impossible for gas companies to supply them and their present customers. It is fair to presume that, in such a case, coke will go to a price that will render water gas a very costly article. Without saying anything about the efficiency of water gas, the only way it can be brought into general and profitable use is for the users to make their own coke. This they can do, and with great economy, as will be advertised very shortly.

T. Nicholson.

Hucknall Torkard, May 18, 1889.

The Gas Economizing and Improved Light Syndicate, Limited.—A Company under this title was registered last week with a capital of £6000, in £1 shares, to manufacture, refine, or otherwise treat, buy, sell, and supply hydrocarbons, and to carry on the business of gas enrichers.

Sales of Shares.—At a recent sale of "A" stock in the *Broadstairs Gas Company*, twelve lots, of £50 each, of the stock, the last dividend paid on which was at the rate of 10 per cent., realized £111 apiece; the remaining lot fetching £110. An odd parcel of £80 of the stock was sold for £175. On the same occasion some lots of £50 of ordinary stock of the *Broadstairs Water-Works Company*, the last dividend on which was at the rate of 5 per cent., realized £57 each.

Liverpool Gas-Fittings Company, Limited.—The thirteenth annual meeting of the shareholders of this Company was held last Tuesday. The Directors reported that there was a net profit on the year's working of £776 13s., which, with a balance from last year of £266 3s., left the sum of £1042 16s. to the credit of profit and loss. It was recommended that a dividend be declared at the rate of 10 per cent. per annum, free of income-tax, which would leave a balance of £42 16s. 2d. to be carried forward. The Chairman (Mr. J. B. Smith), in moving the adoption of the report and statement of accounts, said that it was a matter of regret to the Directors that they could not recommend the payment of a bonus in addition to the dividend of 10 per cent. The inability to pay a bonus was due to the scarcity of small contracts. However, they hoped shortly to have an improved state of affairs. The report was adopted.

The New Gasholder of the Leeds Corporation.—By invitation o Messrs. Clayton, Son, and Co., Limited, of Leeds, the members of the Leeds Association of Foremen Engineers and Draughtsmen, last Saturday week, inspected the large new gasholder constructed by that firm for the Leeds Corporation in the New Armley Road. Messrs. Clayton were represented by Mr. Pickering, who courteously explained the various points of interest. The gasholder is 160 feet in diameter, with three 40-feet lifts; its total capacity being 2,300,000 cubic feet. The tank is 15 feet above the ground, and has a depth of 41 feet. The total height of the structure to the top of the finials is 144 feet from the ground. The "floating" weight of the case is 368 tons. The tank weighs 495 tons; the framing, 278 tons; and the tank-guides, &c., 34 tons—making a total of 1175 tons of ironwork. The framing is exceedingly light and elegant; and the great height of the holder renders it a conspicuous object for a considerable distance along the valley.

Parliamentary Intelligence.

HOUSE OF LORDS.

FRIDAY, MAY 17.

GAS AND WATER PROVISIONAL ORDERS.

A Bill to confirm certain Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act, 1870, relating to St. Ives (Hunts.) Gas, Otley Gas, Pocklington Water, and Marlow Water, was brought in, and (the order made early in the session, that no Provisional Order Confirmation Bill originating in the House of Lords should be read the first time after the 10th of May, having been dispensed with) read the first time, and referred to the Examiners.

The following progress was made with Private Bills during the past week:—

Bill read the first time: Long Eaton and District Water Bill.
Bill read a second time and committed: Great Wigston Gas Bill.
Bills reported: Edinburgh and District Water Bill, Faversham Gas Bill, Great Wigston Gas Bill, Kettering Water Bill, Rastrick Water Bill.
Bills read the third time and passed: Cleveland Water Bill, Eastbourne Water Bill, Kettering Water Bill.

HOUSE OF COMMONS.

MONDAY, MAY 13.

A petition was presented from the Partick, Hillhead, and Maryhill Gas Company for leave to deposit a petition for a Bill.

WEDNESDAY, MAY 15.

The Burnley Corporation Bill, the Garw Water Bill, the Newcastle and Gateshead Water Bill, the Padiham and Hapton Local Board Bill, the Plymouth Dock (Devonport) Water Bill, and the Wakefield Corporation Bill, were referred to a Select Committee, consisting of Mr. Abel Smith (Chairman), Mr. Picton, Mr. Baird, Mr. M. J. Kenny, and Mr. Bonham-Carter (Referee); to meet on Tuesday, May 21.

THURSDAY, MAY 16.

Bills to confirm Provisional Orders of the Local Government Board for Ireland, relating to the Tipperary Water-Works, and to the Listowel Water-Works, were presented, read the first time, and referred to the Examiners.

The following progress was made with Private Bills during the past week:—

Standing Orders complied with: Manchester Coporation Bill.
Bills read the first time: Cleveland Water Bill, Eastbourne Water Bill.
Bills read a second time, and committed: Tuscan Gas Bill, Windermere District Gas and Water Bill.
Bills reported: Deanhead Commissioners' Bill, Liverpool Corporation Bill, Woodhall Spa Company Bill.
Bills read the third time and passed; Bristol Water Bill, Long Eaton and District Water Bill.

WOODHOUSE AND RAWSON, LIMITED.—The general meeting of this Company was held at the Cannon Street Hotel last Friday, when a dividend of 6 per cent. for the past half year was declared (making 12 per cent. for the year), and a balance of £13,440 was carried forward.

THE ELECTRIC LIGHT IN NEWCASTLE.—Our correspondent in the North informs us that canvassing on behalf of the two schemes of electric light now before the city of Newcastle is going on; and he says it is certain that with a few establishments the light will be added to the gas lighting. In the case of one of the companies, it is believed that there will be a commencement with the laying of the wires in about a fortnight.

EXTENSIONS AT THE NEATH GAS-WORKS.—An extension is being carried out in the retort-house of these works by the addition of two benches of six retorts each, with regenerative furnaces on Messrs. R. and J. Dempster's patent system. One bench will be arranged to work the Dinsmore process of gas manufacture, which will be the first adoption of it in South Wales. The whole of the work is being executed by Messrs. R. and J. Dempster, of Manchester, who are also supplying one of their patent automatic governors for these works.

THE SURPLUS PROFITS OF THE BOLTON CORPORATION GAS AND WATER WORKS.—In moving the adoption of the minutes of the Finance Committee at the meeting of the Bolton Town Council last Wednesday, Alderman Kelvin, referring to the local borough debt, which amounts to £2,167,000, said that of this sum the water-works were responsible for £700,000, the interest upon which was paid out of the water-works revenue, and which was paid in addition to the sinking fund and other outgoings. The gas-works was responsible for £565,000 of the total debt, and the interest on this sum was met out of revenue. The gas and water works were producers, and yielded profits in addition to the payment of interest on the capital employed. They last year received from the surplus profits of the water undertaking £10,000; and from the gas-works, £11,500. Gas had contributed in ten years £97,800; and water in the same time, £66,500. He was not in favour of looking for annually increasing sums from the surplus profits of these works; but he thought the Council might hope for the maintenance of the sums which were now being handed over. He believed they might look forward to receiving from them something like £20,000 a year, without transgressing on the rights of either gas or water consumers; and they might fairly take this in aid of the rates.

NORTHERN COAL TRADE.—There has been very great activity in the coal trade of the North during the past few days; partly owing to the exceptional demand from the German and Dutch ports, which is scarcely yet at an end. Coal has been freely sent to Hamburg, Amsterdam, Rotterdam, and one or two of the smaller ports; and this at increased prices and with higher freights. It has withdrawn some coal from the London and other markets; and where coal has needed to be sent to London, advanced rates of freight have had to be paid. For best steam coal, 10s. to 10s. 6d. have been the prices; and the latter in a few instances has been actually paid. Small coal has been very scarce, and commands about 4s. per ton. For gas coal for export the demand has been large; and in one instance 8s. 6d. per ton was paid for a cargo. The general price, however, is from 7s. 6d. to 8s. A large contract for Stockton is in the market; and it is tolerably certain that it will be given to South Durham coal-owners, at an advance—1s. per ton above last year's prices being spoken of as probable. There is little change in other kinds of coal, and the demand for coke of all sorts is extremely large; so much so that for best Durham coke for export as high as 22s. free on board in the Tyne, and 20s. 6d. free on board at West Hartlepool, have been paid. Gas coke is steady.

Legal Intelligence.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

THURSDAY, MAY 16.

(*Before Justices* MATHEW *and* GRANTHAM.)

TAPPENDEN *v.* THE WEST MIDDLESEX WATER-WORKS COMPANY.

REFUSAL TO FURNISH A CONSTANT SUPPLY.

This matter came before their Lordships to-day on a case stated by the Magistrates at the Kensington Petty Sessions (*ante*, p. 162). The facts were as follows:—The respondent in January last made a complaint before the Magistrates that the Company had unlawfully neglected and refused on Jan. 5 and 7 to keep in the pipes laid down in Burnaby Gardens, Chiswick, the water supplied by the Company constantly laid on under pressure for the use of the respondent; he being the occupier of Gunnersbury College, Burnaby Gardens, which is within the limits of supply of the Company, and is supplied with water by them by means of a communication-pipe with their main in Burnaby Gardens; but the water so supplied had never been constantly laid on under pressure. On Dec. 19, 1888, he gave notice to the Company that he was entitled to be furnished by them with a supply of water constantly laid on under pressure for his use at his house; and thereby in conformity with section 43 of the Water-Works Clauses Act, 1847, requested them to furnish such supply forthwith. They declined to provide such supply to the main in Burnaby Gardens, but offered to allow him to make, at his own expense, a connection with a main 140 yards distant, which was kept constantly charged, and by means of which he would have the constant supply which he desired. He, however, declined to incur that expense, contending that they were bound to keep the water constantly laid on under pressure in the main from which his house was directly supplied, and in all the main pipes of the Company within Chiswick. The Magistrates decided that the Company were bound to keep the water constantly laid on under pressure; and under section 43 of the 1847 Act incorporated with the Company's Act of 1852, by which it is enacted that if the Company neglect or refuse to furnish to any owner or occupier the water supply to which he is entitled, they shall be liable to a penalty, they convicted the Company, and inflicted a nominal fine, but stated a case for the opinion of the Court.

Mr. POLAND, Q.C., and Mr. MEAD appeared for the appellants; Mr. MOULTON, Q.C., and Mr. ATHERLEY JONES for the respondents.

Mr. POLAND argued at some length for the Company in support of the appeal.

Mr. ATHERLEY JONES addressed their Lordships in support of the Magistrates' decision. He said that in 1852, the year in which the West Middlesex Company's Act was passed, the Metropolis Water Act was also passed; and this provided that the Companies to which the Act applies—this Company being one of them—should, after five years, subject to their Special Act, provide and keep in their district mains a constant supply of water for each house supplied by the Company. But it was further provided that no Company shall be bound to give such constant supply to any district main until four-fifths of the owners or occupiers of the houses connected with such main should by writing require the Company to provide such constant supply. By section 29 of the Act, the Metropolis was stated to mean and include the places described in the schedule to the Act; and the places mentioned in the schedule were those which now constitute the Metropolis as defined in the Metropolis Local Management Act, 1855, together with three parishes outside that area; but Chiswick was not included. Section 35 of the appellants' Act of 1852 provided that, whenever water shall be constantly laid on under pressure in any district main, every person supplied with water under pressure through such main should provide a proper cistern, &c.; and this Mr. Tappenden had done.

Their LORDSHIPS decided that the Magistrates were wrong, as section 15 of the General Act applied, which required the consent of four-fifths of the inhabitants to the requisition of a constant supply; and they accordingly allowed the appeal.

AN ELECTRIC LIGHTING PROJECT FOR STOCKPORT.—A scheme has been formulated for the supply of electricity for lighting purposes in Stockport; and the promoters are endeavouring to float a Company in order to carry out their ideas. It is estimated that £10,000 of capital will be required, which would be sufficient to put down plant for 2500 16-candle power lights; and the working expenses are placed at £1200 per annum. The charge to the customer, it is stated, would be equal to 10s. per 10-candle lamp. On this basis, says a local contemporary, the shareholders will earn a dividend of 13 per cent.!

TODMORDEN GAS COMPANY.—The nineteenth annual report and balance-sheet of the Todmorden Gas Company have lately been placed in the hands of the shareholders. The report shows the profit to have been £3179 14s. 7½d.; and from this sum the Directors recommend the following dividends (less income-tax):—On the consolidated stock 10 per cent., 2½ per cent. for dividends in arrear, and 7 per cent. on the £5 paid-up share capital. These dividends, with 4 per cent. on the calls paid in advance, will absorb £3053 19s. 5d.; leaving a sum of £135 15s. 2½d. to carry forward. The result of the year's working has enabled the Directors to make a further reduction of 3d. per 1000 cubic feet in the price of gas from the 1st of July next.

REDUCTION OF THE WATER-RATE AT WAKEFIELD.—At the last meeting of the Wakefield City Council, Mr. Booth, the Chairman of the Finance Committee, in moving the adoption of an estimate for a new general district rate of 4s. 4d. in the pound, made a brief reference to the improved position of the Water Department, which, he said, had been the chief source of expense during the last few years. He was glad to say they were just turning the corner; and he hoped the expenditure would decrease year by year, and that the receipts would increase, so that the ratepayers would receive the benefit of their long patience and ultimate faith in the success of the water scheme by a yearly decrease of the rate-in-aid. In this department last year, they had a rate-in-aid of 2s. 2d. in the pound; and they now proposed to levy a rate of 1s. 10d., and a rate of 2s. 6d. for other purposes—making together 4s. 4d. They saved the 4d. on water account by a reduced expenditure on the old works, by the abandonment of the works at Stanley Ferry, and by an increased estimate of revenue receivable from the water-rents, and which, he believed, was under-estimated rather than otherwise, because they had not taken into account any receipts from Featherstone or Methley, or anything extra from the Rural Sanitary Authority; and he believed they had a fair right to say that the Rural Sanitary Authority would consume more water, and that Featherstone and Methley would both be taking water before the financial year closed. He, therefore, thought the basis of the estimate a safe one; and he had pleasure in moving its adoption. Alderman Reynolds formally seconded the motion, which was adopted, after a brief discussion, in which all the speakers congratulated the Finance Committee on the reduction of the water-rate.

Miscellaneous News.

ELECTRIC LIGHTING IN THE METROPOLIS.

Major Marindin's Report to the Board of Trade.

Major Marindin has made his report on the recent inquiry, and copies of it were forwarded last Saturday to the Chairman of the London County Council (Lord Rosebery) by the Secretary of the Board of Trade (Mr. Henry G. Calcraft), accompanied by the following letter:—

Electric Lighting Acts, 1882 and 1888.

My Lord,—I am directed by the Board of Trade to transmit to you the enclosed copies of Major Marindin's Report, made after his inquiry, held by direction of the Board of Trade, into the various applications for Provisional Orders and Licences under the above-mentioned Acts, in respect of the Metropolis, as well as into the subject-matter of a Bill introduced into the House of Commons by the Metropolitan Electric Supply Company, Limited.

In forwarding copies of this report for the consideration of the County Council, I am to inform you that, subject to any observations that they may wish to offer, the Board of Trade propose to adopt the recommendations of report with regard to the allocation of the various districts to the several Companies.

A description of these areas will be found in the report, from which it will be seen that in the following districts only powers over the same area are proposed to be granted to more than one Company, viz.:—St. George's, Hanover Square; a small portion of the parish of Lambeth to the north of Westminster Bridge Road; a small portion of the parish of St. Martin-in-the-Fields to the east of Northumberland Avenue and St. Martin's Lane.

The Board of Trade concur in the opinion expressed by Major Marindin that, looking to the fact that the supply of electricity on the alternating current and transformer system cannot be made use of for motors, the competition of a system which can be made useful for motors is desirable; and that, consequently, where powers are granted within the same area to two Companies, both those Companies should not be those using alternating currents. This principle has been adopted in allocating the various districts, except in so far as regards a small portion of the parish of Lambeth to the north of Westminster Bridge Road, which has been allotted to the London Corporation and the Metropolitan Company, both of which propose to use alternating currents and transformers.

The latter Company was the only one which proposed to take the whole of the parish; and they are in possession of a site for a generating station in the northern corner of the parish. The whole of the parish was, therefore, allotted to this Company; but it was found necessary also to grant powers to the London Company over a portion of the parish, in order to give access to the districts allotted to it on the other side of the Thames.

A small portion of the parish of St. Martin-in-the-Fields has been allotted to the same two Companies. But in this instance the latter Company possess a generating station in Whitehall Place, from which the supply is by a continuous current.

In two of the parishes allotted to the London Company—viz., Chelsea and St. James's, Westminster—powers to supply electricity have already been granted to other Companies by Provisional Order and Licence, granted in the years 1886 and 1888 respectively. Both of these Companies, however, use continuous currents.

In the present Orders it is proposed to substitute for the provisions as regards Schedule A and Schedule B, hitherto usually adopted, a provision that the undertakers should be bound at once to lay down mains in certain streets to be scheduled, and that they should be compelled to lay mains in any other streets in the area on requisition by owners or occupiers.

With regard to the question of capital, I am to point out that, while the capital of the various Companies would doubtless be wholly inadequate if the entire areas allotted to them required to be lighted at once, they possess, in the opinion of the Board of Trade, sufficient capital to provide for all the work they are likely to be called upon at present to perform.

As regards the maximum price chargeable, the Board of Trade, in the absence of any evidence that such a price would be excessive, propose to adopt the maximum of 8d. per Board of Trade unit. They think, however, that a clause should be inserted providing for a revision of the terms of charge at the end of seven years from the date of the Order, and they propose that this clause shall be so drawn as to make it possible to adopt, as regards electrical lighting, the principle of the sliding scale of charge, which has been applied with advantage under the Gas Acts. It is impossible at present to foresee the initial price which it will, at the end of that period, be reasonable to prescribe; but, following the analogy of gas, and considering that the Electric Companies only have a certain tenure of 42 years, the Board of Trade are of opinion that a price arranged on the basis of a 10 per cent. dividend would not be unreasonable.

With a view of saving time, the Board of Trade are now going through all the objections raised to the clauses of the Orders, and are preparing a Model Order, which, with the necessary variations for the varying circumstances of different districts, would be adopted for the whole of the applications, and, that, as soon as this Model Order is in a sufficiently advanced stage, a copy will be forwarded to the County Council.

In conclusion, I am to state that, as time is of the utmost importance, the Board of Trade would be glad to be favoured with the observations of the London County Council at their earliest possible convenience.

In his report Major Marindin details the course he pursued in the inquiry, together with many particulars respecting the Companies and their systems of supply. The following are his conclusions:—

"1. That it must be admitted that the science of electric lighting has now reached the point at which a supply can be made which will be of very great benefit to the public, and that the power of obtaining this supply should be within the reach of all persons who may require it. For this reason it seems to me that, although the wishes and opinions of the local authorities in the areas proposed to be supplied should be consulted and deferred to as far as possible, the mere objection by a local authority to the introduction of a company proposing to supply electric light upon general grounds should not be considered sufficient to exclude such company, unless the local authority should express its intention to undertake the supply, and give evidence that it proposes to apply for permission to do so; and this should apply with more force when it can be shown that the exclusion of a company from such an area would injuriously affect the service of other contiguous areas.

"2. That, in dealing with this question, it should be considered as one affecting the interests of the Metropolis as a whole, and as an area, which at no very distant time may be, for purposes of lighting and management of roads and streets, under the control of one central authority; and that, therefore, the whole of the Provisional Orders granted for the Metropolitan area should, as far as possible, be identical in form, with identical provisions as to supply, compulsory powers, interference with streets, and, more than all, as to price. In my opinion, the scheme, adopted in 1883, of dividing the area of supply into two areas, A and B, would not be likely to work so much to the advantage of the public as the proposal in most of the Orders under consideration to make the supply compulsory under requisition over the whole area upon equal terms. I consider, however, that, in order to ensure that some work shall be at once undertaken in every parish or district within the area of supply under such Order, there should be a list of streets scheduled for compulsory laying of mains, and a deposit made in every case where the local authority may wish to have it. Where there are two Companies in the same area, different streets should be scheduled for each. With regard to the clauses affecting supply, interference with streets, testing, position of stations and distributing boxes, and other details, the whole of the suggestions made by the local authorities should be carefully weighed, and those which are considered necessary embodied in the model form of Order. With regard to price, I do not consider that any one district in the Metropolis should be put in a better position than another. Taking the area as a whole, it does not appear that it would be wise to fix a lower maximum than 8d. per unit. It is true that the London Company is now supplying at 7½d., and the maximum in the St. James's and Pall Mall Company's Licence is 7d.; but these Companies are competing in an exceptionally good area. There would, however, appear to be a necessity for a reduction of the high rate for minimum supply—that is, the sum which every customer taking a supply can be called upon to pay, irrespective of the amount which he has consumed, and which in the Orders varies between £3 6s. 8d. per quarter in the case of the Notting Hill Company, and £5 10s. in the case of the Metropolitan Company's South London Order. The latter Company has consented in the Mid-London and West London Orders to reduce the minimum to 13s. 4d. per quarter; and I consider that whatever minimum is fair should be adopted throughout. The provision for revision of price after each seven years, in the agreements between the Metropolitan Company and the Strand and Marylebone Local Authorities, seems to me to be somewhat contrary to the policy of Parliament when dealing with the Electric Lighting Act. If any such provision be inserted, it should be general; and it would appear to be more fair that the revision should take the form of a sliding scale, upon the basis of a 10 per cent. dividend—the standard being fixed after the experience gained by the working of the first seven years. It has been suggested that in the matter of price the consumer should, if he elects himself to pay the whole cost of connecting his house to the mains, have no minimum at all imposed upon him; but, although I can see no objection to this proposal, such a provision would hardly be necessary where the minimum is reduced as in the Metropolitan Orders.

"3. That in every case the supply of electricity, whether by a company or by a local authority, should be under statutory obligations as well as statutory powers, by means of a Bill, a Provisional Order, or a Licence.

"4. That there is no objection to the granting of a large area of supply to any Company which shows that it has sufficient capital and is capable of coping with the demand. On the contrary, a large and rich company is likely to be the best and most economically-managed concern, to be able, by working over a large and scattered area, to develop the demand for the light, and by rapidly increasing its business to be the sooner in a position to reduce the price of the article supplied.

"5. That, in the abstract, competition is desirable, as tending to keep down the price, and to cause the manufacture and supply of electricity to be carried on with all the attention and energy which it is possible to devote to it. The competition with gas, which—at present, at any rate, and probably for many years to come—will appeal to a totally different class of customers, will not be nearly so effective; while the potential competition from the power of calling in a new company in an area badly served is not likely to be called into play until the bad service has passed through many degrees, and has reached a very low ebb indeed. The question as to how many companies should be granted concurrent powers in one area requires more consideration. In cases where the local authority objects to the entrance of any company, and it is decided to overrule the objection, I think that one company only should be granted powers. In cases where two or more companies have obtained the assent of the local authority, the following facts must not be lost sight of:—(1) That the laying of the mains of several companies up one street means so much dead capital, and moreover, the provision of a certain amount of useless material, which the local authority would have to pay for if it should decide to purchase the undertakings after the lapse of 42 years. (2) That, no matter what regulations or stipulations may be made as to the laying of mains, the interference with the streets, and the consequent inconvenience to the public must be in a certain degree proportionate to the number of companies having powers over these streets. For these reasons I am of opinion that, for the present, powers should not be given to more than two companies over the same area; and, inasmuch as the companies supplying under the alternating current and transformer system cannot supply electric energy capable of use for motors, that both these two companies should not be those using this system. In order, therefore, to leave room for the entrance of a direct supply company into an area where two alternating current transformer companies have been assented to, it will be necessary to choose only one of these companies; and this will lead to a certain amount of districting.

"6. That wherever a company now supplying a district by means of overhead wires is granted an Order for such area, it should be placed under the obligation to remove these overhead wires within a period of two years from the granting of the Order; and, if such a thing be possible, that this company should be prevented from invading a district in which it has not got powers by means of overhead wires.

"7. That, in order to reduce as much as possible the disturbance of streets, clauses should be drafted making it obligatory for companies to lay their mains in existing subways, and to transfer them into subways which may be made in the future, upon being called upon to do so. If possible, it would also be advisable to provide that, wherever circumstances admit of it, and where there is no subway, the conduits put down to lay the mains should be made capable of accommodating the mains of both companies in the area, if there be two companies having powers therein. To a certain extent, also, it would appear to be right that the local authorities should have the power of objecting to the sites for generating, as distinguished from distributing, stations, subject to an appeal to the Board of Trade."

Major Marindin applies the foregoing principles to the various Orders asked for, and then adds:

"It should be understood that in every case the recommendation to grant these Orders is on the understanding that the whole of the works, both at the generating and other stations, and along the mains, are to be planned and executed in a manner such as to satisfy the Board of Trade that the public are properly protected, both as regards safety and, so far as may be possible, from any extinction of the light for an appreciable time, and that, should it be found impracticable to carry out the districting between the London and Metropolitan Companies in the manner

which I have proposed, the whole question will be reconsidered, so that the areas may be fairly readjusted.

"The Metropolitan Orders for the Strand and Marylebone should be in as nearly as possible the same form as those applying to other parts of the Metropolis, as there does not appear to be any sufficient reason for treating these areas differently from any others.

"The only districts applied for in which I have decided not to recommend the granting of Orders, as amended, are the parishes of St. Pancras and Paddington, where the Local Authorities should, I think, be granted time to decide definitely whether or not to carry out the lighting of their parishes under the powers of a Provisional Order; and the City, which, although not exempted from the operation of the Electric Lighting Acts, is in a somewhat different position from other parts of the Metropolis.

"The Commissioners of Sewers, acting for the Corporation, are endeavouring to obtain tenders for the lighting of the City; but I see no reason why the principle that all such lighting should be done under statutory powers and obligations should be departed from in their case.

"If the Board of Trade should agree in this view, I would urge the Commissioners of Sewers to consider whether the Orders, as remodelled, do not sufficiently provide for all their requirements, and in that case to consent to the division of the area of the City between the two competing companies—viz., the London and the Metropolitan Companies—the latter Company being allotted the portion nearest to the Strand district, and the former the central and eastern portions of the City, so that access may be given to the parish of Clerkenwell, the Vestry of which wishes for an Order to be granted to this Company."

BOARD OF TRADE INQUIRY.

(Before Major MARINDIN, C.M.G., R.E., *assisted by Captain* CARDEW.)

TWELFTH DAY—WEDNESDAY, APRIL 24.

On the resumption of the inquiry to-day,

Mr. *J. B. Martin* was called and examined by Mr. WALLACE. He stated that he was a Director of the Westminster Electric Supply Company, which was incorporated to supply electricity in Westminster. The nominal capital of the Company was £100,000. All the portions of the City of Westminster had been abandoned during the inquiry, with the exception of the parishes of St. Margaret's and St. John the Evangelist, and St. George's, Hanover Square. The actual capital subscribed—£8000—had been paid up for the purpose of arranging as to the purchase of sites and putting up the small plant adjoining the Victoria Mansions. Three sites had been secured; and negotiations were going on for two others. This was besides the battery station. They were all riverside sites; and two of them were wharves.

Mr. WALLACE: Have you entered into any contracts for the erection of plant?

Witness: Yes; with two large firms—Messrs. Crompton and Messrs. Latimer Clark, Muirhead, and Co. The parishes of St. Margaret's and St. John's are to be allotted to Messrs. Crompton, and St. George's, Hanover Square, to Messrs. Latimer Clark, Muirhead, and Co.

Has a site been purchased adjoining your own property at Victoria Mansions?—Yes; and it is intended to be used afterwards as a battery station, and the plant there as auxiliary plant. At present only the boilers have been put down; but the dynamos and the other machinery are ready.

How soon can you supply electric light?—Possibly within a month. Certainly in six weeks at the outside.

Cross-examined by Mr. PEMBER, witness said the real business of the Company was to supply electric light. They had no patents to sell. He could not say exactly how many shareholders there were in the Company; but he believed about 20. The nominal value of the shares was £10; and he held £50,000 worth. This was half of the capital; but £100,000 was not the whole amount to be raised, for, if necessary, they had power to raise more by debentures or otherwise. The installation at present being fitted up would cost £8000, and it would supply 5000 lights. They had arranged for 100,000 lights in the first place; and the cost would work out to about 35s. per light including everything.

Mr. *Latimer Clark*, examined by Mr. WALLACE, said he was head of the firm of Messrs. Latimer Clark, Muirhead, and Co., and had had considerable experience in manufacturing electrical appliances, and in laying underground mains for telegraphic purposes. They had erected the St. James's central station, which was now at work satisfactorily. At present they were only furnishing light on a small installation, not at all on the full scale. His Company had entered into a provisional contract for the supply of electrical plant for lighting the parish of St. George's, Hanover Square.

Mr. WALLACE: How long do you anticipate it will take you to supply a plant for (say) 40,000 lights?

Witness: To commence giving the light, it would take about four months from the time of getting the order to proceed. To complete it all, from six to seven months. I presume you mean the laying of the mains.

Yes. How many lights would you be able to supply from the station?—20,000; and another 20,000 in a few months longer, without any undue haste.

Mr. PEMBER: You say you have a contract. Is it to supply as many lights as the Company choose?

Witness: Yes.

For how much?—Our estimates are about 60s. This is not a contract price, but one which has to be hereafter settled by arbitration. We have advised Mr. Martin that we can do the whole thing completely for 35s. a light—10-candle light.

Mr. MOULTON: What is the system you propose?

Witness: The ordinary three-wire system, assisted by batteries at the out-station.

Mr. *Killingworth Hedges*, in answer to Mr. WALLACE, said that, speaking for three clients, there was a desire to have the electric light. Those clients were the St. Stephen's Club and the Aërated Bread Company. The latter had two shops in Westminster they were anxious to have lighted; but, so far, they had not been able to satisfy their wishes. There was a great demand for the light in the vicinity of the Company's station which was being erected. The lights now being provided for would, he thought, be at once taken up in the immediate neighbourhood. It was a *sine qua non* at the St. Stephen's Club that the supply should be from the direct system with storeage batteries.

Mr. T. HORN (who watched the proceedings on behalf of the St. John's and St. Margaret's Vestries) desired to know how many of the inhabitants had applied to be lighted by the Company under the direct system.

Witness replied that he could not answer for anyone but his own clients, and therefore was unable to say how many had applied. But besides the St. Stephen's Club and the Aërated Bread Company, the Institution of Civil Engineers had come to him respecting a supply which they would have as soon as permission was granted to run the wires.

Major MARINDIN: Have they applied to the Company?

Witness: I cannot say.

Mr. PEMBER: As a matter of fact, they have applied to us.

Mr. *Anderson*, examined by Mr. WALLACE, said he was electrician to Messrs. Latimer Clark, Muirhead, and Co., and had erected, under their supervision, the station at St. James's. So far as it had been in operation, it had worked satisfactorily. At present there was no battery at St. James's; but at St. George's, Hanover Square, they had a supply system.

By Mr. GRAHAM: The system is the ordinary three-wire one. All the mains will be trebled; and we propose to use batteries occasionally as a standby and for regulation purposes. Our lamps are to be joined n parallel to the dynamos?

Mr. GRAHAM: Taking the number of lamps at 40,000, have you calculated the number of batteries you would require filled—how many cells?

Witness: The number of cells hardly depends upon the number of lamps. There would be 106 cells at a station—two groups of 53.

Major MARINDIN: That, I think, closes all the promoters' cases.

Mr. F. L. MUIRHEAD, on behalf of the St. James's and Pall Mall Electric Light Company, Limited, then said he objected to the Orders of the London and Metropolitan Companies. The St. James's Company was incorporated at the beginning of March last year, and was started in that district, as it was the principal one requiring electric light. The reason for starting it was because there was great complaint in the St. James's district at the unsatisfactory lighting of the Grosvenor Gallery; and it was at the request of a number of persons that the Company should be formed to devote its attention entirely to the requirements of the parish. The area was roughly divided into the north and the south. One area—that south of Piccadilly—would contain all the clubs and a great many public buildings, which required long hours of lighting. The other area—that north of Piccadilly—was a poorer district, inhabited by workpeople, who would need motive power. So that the Company designed its system to meet the wants of both areas. The Company did not intend to go beyond the boundary of the parish, and had therefore accepted all the amendments proposed by the St. James's Vestry. The capital of the concern was fixed at £100,000; but there was power to increase the amount. The first £28,000 was subscribed; and the number of shareholders was 60. The Company had purchased a site at the cost of £9500. There had been spent £8500 in the construction of the necessary buildings; and the Company had entered into a contract for the supply of machinery for 10,000 lights, at a cost of £18,500. The contract was divided into two sections—the first, for 5500 lights, was for £11,000; and the second, for 4500 lights, for £7500. The first portion of the contract was now practically completed; and the Company were about to lay down the mains. The system adopted was the low-tension one; and the distribution was by the three-wire system. The Company proposed to establish a network of mains through every street in the southern part of their district. There would be a ring main running down St. James's Street, along Pall Mall, up Regent Street, and along Piccadilly; and this main would be connected, by means of feeders, to the stations.

Mr. *E. Balfour*, examined by Mr. MUIRHEAD, said he was Chairman of the St. James's Company, and had been connected with it since its formation. The Company proposed to confine their operations strictly to St. James's district, and to adapt all their arrangements to its requirements. The site of the first central station was to be in Mason's Yard; and its capacity was to be 35,000 10-candle lights. They would have accumulators and ample room for any possible number that might be required, by which, he was informed, they could at any given moment bring the capacity of the station to 50,000 lights. There would be the ordinary margin of one-third; so that they would be able to supply to the parish, from this station alone, electricity for from 60,000 to 80,000 lights. The Company had already, by a temporary main, lighted one club very satisfactorily. In the southern portion of the area, there were clubs, several banks, important hotels, one or two large stores, and some very good shops; so that it was a district where the Company expected almost every person would adopt electric lighting. Such a district undoubtedly required that special arrangements should be made for lighting it. The Company proposed to establish another station at the northern part of their area, and perhaps connect it with the southern half; so that, in the improbable event of a breakdown in the machinery in the southern portion, the northern half would be able to produce the current. The current the Company intended to send out would be capable of supplying storeage batteries and motors. They had no transformers. They proposed eventually to use storeage batteries, although their system would work satisfactorily without them. Arrangements had been made to obtain further capital if necessary; and there would be no difficulty in getting it.

Mr. PEMBER: Are you an enemy of competition?

Witness: I am in this sense—that I think every company started under the favourable auspices under which we start ought to have the opportunity of satisfying the Board of Trade that it can, by itself, properly supply the district; that is, to have a monopoly so long as we behave ourselves.

Then you are an enemy to immediate competition? In other words, you object to my getting my Order from your parish?—Yes; in the interests of both the parish and the Company.

Do you know how Messrs. Latimer Clark, Muirhead, and Co. are to be paid—is it by a lump sum or so much per lamp, or how?—They are paid by instalments; but the contract for 10,000 lights has not been completely taken up, only engines and dynamos ordered, which will cost £5000.

Are you going on the same principles as the last company of paying them so much per light?—No, it is a definite contract for a settled sum—£11,000 for 5500 lights, bringing the whole up to £18,500 for the 10,000 lights—that is 16-candle power lights.

Major MARINDIN: You said 10-candle before.

Witness: The 35,000 applied to the 10-candle power lights; the figures I have just given apply to the 16-candle.

Mr. PEMBER: Just tell me again how many 16-candle lamps there are?

Witness: The present contract is for 5500.

Then to turn them into 10-candle would be as 10 to 16?

Lord CRAWFORD: It is nominally 16—it is twice 10.

Witness: 11,000 then. If Lord Crawford says two 10-candle power lamps equal one 16-candle, the figures I gave as 35,000 ought to be 44,000. It makes a very large increase in the nominal capacity of light.

Major MARINDIN: That is to say, your 35,000 10-candle power lamps ought to be 44,000?

Witness: That is what it is on that basis.

Mr. PEMBER: Your contracts are for the supply of 11,000 10-candle lights?

Witness: That is the first contract already entered into, and practically complete.

And when the second section is done, how much?—It would be 20,000 10-candle lights. There remains after that the possibility of putting it up to 44,000.

In answer to Mr. A. C. CRIPPS, witness said he was not in favour of any Licence being given to a rival company until it could be shown that the St. James's Company could not satisfy the public.

Mr. CRIPPS: We are in the same position as you are, having obtained the assent of the Vestry and the sanction of the Board of Trade, and do you still think we shall be excluded?

Witness: Yes.

Mr. *J. Hemmerde*, a Director of the St. James's Company, said, in answer to Mr. MUIRHEAD, that the paid-up capital was about £28,500; and of this about £10,000 had been expended on the freehold. For the buildings the contract was £8500; that for the machinery erected and to be erected was about £11,000.

After a conversation respecting the order in which the cases for the Vestries should be heard,

Mr. STOKES addressed the Inspector for the Rotherhithe Vestry, who, he said, objected to overhead wires. They also thought they were insufficiently protected in regard to the breaking up of the streets unless certain sections in the Metropolis Local Management Act, 1855, were made applicable to the electric lighting companies in the same manner as it was to the gas and water companies. At present the Vestries had not the power to deal effectively with electric lighting companies in the matter of breaking up the streets; and a clause should be framed to make it compulsory that sufficient notice should be given, and that the repairs should be properly done. The Vestry objected to the London Electric Supply Corporation having the power to interfere with any drains or sewers unless by the consent of the Local Authority.

Major MARINDIN: May I take it that the Rotherhithe Vestry do not object to the general Order?

Mr. STOKES: No; they want a protecting clause with reference to the laying of mains and interference with sewers and drains.

Mr. *G. Legg*, Architect and Surveyor of Sewers, and Mr. *E. Thomas*, Surveyor of Roads and Pavements, briefly gave evidence in support of the case of the Rotherhithe Vestry, as stated by Mr. Stokes.

Mr. NASH (the representative of the Paddington Vestry) then said his Vestry objected generally to the Orders of the Metropolitan, the London, and the Electrical Storeage Companies. These Companies practically proposed to restrict their operations to private individuals, and not to undertake the lighting of the streets or the public lighting generally. There was one essential difference between the proposals of the Metropolitan Company and those of the Storeage Company. The former proposed to take the whole of the parish; whereas the latter wished only to take a small part, which was arbitrarily selected as the best and the richest, and therefore the most paying portion of the parish. At present there was no very great demand for electric lighting in Paddington; and this would seem to be a cogent reason why no power should be given to companies simply to enable them to experiment on the locality at the expense of the inhabitants. There was a further and special objection to the Storeage Company; and this was that the proposed capital to be devoted to this particular area—£30,000—was to be subscribed by individuals who were shareholders of the Company. Another objection was that the Vestry were anxious to take the lighting of the area into their own hands. The matter had been under their consideration for many months. Some months previously they instructed Professor Forbes to report to them as to the advisability of the Vestry undertaking the lighting. As the result, a very full report had been presented, which dealt also with the question whether the Vestry should themselves apply for powers. He pointed out the cheapest and most effective way of carrying out the works and using the land which belonged to the Vestry for the purpose, and stated the incidental advantages which would accrue to the neighbourhood if the Vestry obtained the powers sought for. Professor Forbes showed, too, that the cost would be much less if the lighting was undertaken by the Vestry; and gave other reasons setting forth the advantages of the course suggested.

Major MARINDIN: Are you prepared to say for the Vestry that they propose to go for an Order to light the district?

Mr. NASH: The matter has stood over pending this inquiry. But, without actually pledging the Vestry, I may state that they would be prepared to take up the lighting. Perhaps you may think it desirable to put them under some undertaking as to that.

Major MARINDIN: No; I only wish to know the position of the Vestry, and what they are prepared to do.

Mr. *F. Dethridge*, Vestry Clerk of Paddington, examined by Mr. NASH, said the Vestry objected very strongly to the granting of Provisional Orders; and the matter had been the subject of earnest consideration for months. The Vestry was sincerely desirous to obtain electric lighting, and wished to study the interests of the ratepayers. The Vestry wished to get rid of monopoly, and give the ratepayers the benefit of the profit that might be made. It was quite true that competing companies would make the matter better for the public; but opposition companies generally shook hands, and obtained a system of districting for which the public had to pay.

Mr. MOULTON: There is a portion of the district which does not use gas—something like one-third of the parish of Paddington.

Witness: That may be so; but it is difficult to prove it. They may have regard for their ceilings; and so the electric light would be more popular with them.

Do you think the people in Paddington who do not use gas do it from consideration of their ceilings?—Are there not a large number of houses in the north of Paddington which are inhabited by persons who cannot afford to pay for gas?—It may be so with some; but there are not a large number.

Speaking as a practical man, do you think there would be much demand for the electric light in the northern part of the parish?—Not in the extreme northern part.

Mr. NASH: Has the Vestry a good site?

Witness: Yes; and the Company has not acquired one—in fact, it is *in nubibus*.

Professor *Forbes*, examined by Mr. NASH, stated that some months ago he was requested to advise the Paddington Vestry as to the advisability of undertaking the electric lighting in their own district; and he made a report to the Vestry on the subject. It showed as clearly as possible the points in favour of their doing the work themselves; and it appeared clearly, on the evidence, that the profits would go to the parish instead of to the Company if the former took the work in hand. He had investigated various systems, and had come to the conclusion that the street lighting ought to be done by the continuous-current high-tension arc system, and the domestic lighting by the alternating-current system. One of the principal points brought before him was the Vestry's desire to have the arc lighting introduced immediately and completely over every part of the parish; and by laying conduits for it, they would be enabled, at a few days' notice, to supply the current to any house in which the light was desired. He had considered what the cost would be, and had come to the conclusion that the Vestry could do the work much cheaper than any company. A company with underground mains would have to charge above £30 per light per annum for a continuous arc light; whereas the Vestry could do it for about £20, and at the same time save some expenses incurred by companies. As to the domestic lighting, he had estimated 15,000 actual 16-candle lamps to be put up first, which would mean 30,000 nominal 10-candle lamps; and putting these up to begin with, the charge came out at 4¼d. per Board of Trade unit. Undoubtedly there were various reasons why the Vestry had an advantage over a private company. In the first place, the cost of the works would certainly be cheaper to them. In the case of the Vestry, the capital expenditure would be £95,000 for 200,000 lights. For the purpose of his estimate, he had divided the district into two parts, one of which he had scheduled "A" (that lying South of the Great Western station) and the other "B" (on the north of the station). The estimate for "A" would come to £95,540. The annual expenditure for the street lighting would be about £9000, and for the private lighting about £9390. If the Vestry undertook the lighting, there would be a great many charges which would not come in as they would in the case of a company.

Mr. MOULTON: What are the points on which there would be a saving if the work were undertaken by the Vestry?

Witness: In laying down mains; in the greater facilities for purchasing land; in a lower rate of interest on the money borrowed for the purpose; and in the utilization of dustbin refuse.

First of all this dustbin refuse. It is not very expensive to buy if anyone wanted to burn it?—I cannot say; but the Vestry would have more experience than a company in utilizing the refuse, as their Surveyor naturally knows all that is done in that way.

As to laying down the mains. You say in your report: "The introduction of competing companies would probably lead to disaster among some of them, and injury to the consumers"?—It should be "may" lead to disaster.

You have not had any station under your care, have you?—I was the first to start a central station in London, in Regent Street, in 1881. It lasted six months, and was stopped by injunction. It supplied 300 lights.

In answer to further questions, witness said that the Vestry would, if they had the matter in their own hands, be able to save the interest to the shareholders, Directors' fees, and in some cases royalties, with which certain companies had their capital greatly burdened. His estimate was well within the mark—in fact, he had taken it rather too favourably for the companies.

Mr. H. L. CRIPPS then addressed the Inspector on behalf of the Strand District Board of Works. He said that, subject to certain reasonable conditions, the Board would consent to the application of one of the companies for a Provisional Order, but opposed all the others. He desired to impress upon the Board of Trade the views which the Local Authority in his district took with regard to the Electric Lighting Act of last session, which was in the nature of a concession, but had been treated by the companies with silence. That had put the local authorities in a very different position from that in which they were placed before it was passed. Under the Act of 1882, the responsibility for dealing with applications for Provisional Orders was taken away from the local authorities, and vested in the Board of Trade, which body was absolutely empowered to deal with companies supplying electricity in any area. The Act of last session, however, gave the companies what they sought—the additional 21 years, by which they hoped to obtain their capital more easily. But it contained a very important alteration—viz., that the discretion which was taken away from the local authorities was expressly re-vested in them; and it was provided that, notwithstanding anything in the Act of 1882, no Order authorizing the supply of electricity by any undertaker within the district of any local authority should be granted by the Board of Trade without the consent of such local authority, unless the Board thought that such consent should be dispensed with, in which case they would have to make a special report setting forth the grounds on which they dispensed with it. No doubt special circumstances might arise in which such dispensation would be necessary; but the reasons would have to be very cogent, and such as did not exist in the present instance as affecting the Strand district. The Strand District Board of Works had seriously considered the whole question of electric lighting in their district, and the position in which they found themselves in connection with the competing companies. There were five different companies making application for Provisional Orders; and the District Board first considered whether any, and if so which, of those companies were in such a financial position, and generally of such a character, that support could be given to it. He had rather lost sight of some of the applications, and was not quite sure which were left.

Major MARINDIN: I can tell you, if you wish to know. The House-to-House Company has disappeared; and the Westminster Electric Supply scheme has been abandoned.

Mr. CRIPPS said this left them with the Electrical Power Storeage Company, the London Electric Supply Corporation, and the Metropolitan Electric Supply Company. They had put out of sight altogether the Electrical Power Storeage Company; and therefore they had only the two Companies to deal with. As far as financial stability was concerned, there was apparently no reason to give the preference to either of them; and so the District Board decided that, if satisfactory terms could be arranged with one, it might, as far as its financial position went, be fairly entrusted with the lighting of the district. The Board next considered the nature of the terms upon which the two Companies named proposed to supply electric lighting in the area; and they came to the conclusion that there were certain points in the Order of the London Electric Supply Corporation which rendered it unsuitable for application to their district. Having enumerated these, the learned Counsel said the District Board had ultimately entered into an agreement with the Metropolitan Electric Supply Company; and according to the proposals contained therein, notice was to be given to the Board of the normal pressure at which the electricity was to be supplied; and in the event of there being a greater deviation than 2 per cent. from that pressure, the Company would have to pay a penalty. The price proposed to be charged was somewhat more favourable to the consumer than that specified in the Order. The next question was as to the revision of price. He thought that it would be impossible to lay down any definite price, and that it was quite sufficient protection for both the local authority and the consumer that they should have an opportunity of going before a proper tribunal seven years hence, and of dealing with the question of price. Something had been said about a sliding scale; and he fully appreciated the value and importance of such a scale. But the question was whether, in the existing condition of electrical knowledge, a sliding scale could be properly devised. The District Board had therefore come to the conclusion that, although they might have to propose a sliding scale later on, it would be better to meet the difficulty now by having a general provision for a future revision of prices. The agreement next provided that the Company should keep at the offices of the District Board a sufficient number of indicators to show the pressure in the mains. Then there was a proviso as to securing payment for the supply of light, whereby the undertakers might require the consumer either to give security, asspecified by the Order, or pay in advance. There was also a provision for purchasing the undertaking. The District Board had made up their minds as to what they considered reasonable for their district; and the Company had agreed to it.

Major MARINDIN: That practically means that, supposing the Board of Trade should disagree with any of these amendments the Company will abandon their Order.

Lord CRAWFORD: That is what it practically means

Mr. Cripps said this was subject to a reservation; and it could not be supposed that the District Board would not reconsider any particular terms of the agreement if the Board of Trade suggested it. This would be a matter for further consideration for the Board of Trade, who, he believed, would be rather glad to find that one Local Authority at least had taken upon themselves to settle an agreement with which both the Company and the district were satisfied. The agreement did not force any monopoly; and it had considerable advantages. The whole method of disturbing the streets was placed under the absolute authority of the District Board; and both the parties would have a sort of joint responsibility for making the scheme a success. No doubt in this way there would be co-operation between the Company on the one hand and the officers of the District Board on the other. The position would, however, be altogether different if a company who were not wanted by the Local Authority succeeded in inducing the Board of Trade to allow them to force themselves into a particular district under the terms of a Provisional Order.

THIRTEENTH DAY.—THURSDAY, APRIL 25.

Upon the inquiry being resumed this morning, Mr. H. L. Cripps continued his address for the Strand District Board of Works. He said there was one question of fact which seemed very pertinent to the inquiry with regard to which he had not yet been able to satisfy himself. It was as to whether there was an agreement between the experts on the various sides as to the amount of coal which would be required for consumption for the purpose of obtaining any specific quantity of electric light, according to either the one or the other of the systems to be employed. It was a matter having an important bearing upon the question of stations in and out of London.

Mr. Moulton replied that the supporters of the different systems would give very different accounts of the quantity which would be necessary.

Major Marindin: Mr. Cripps wants to know if any definite information can be given as to the quantity of coal required to produce a given amount of electricity upon the two systems.

Mr. Pember stated that already a large amount of evidence on the subject had been given.

Mr. Cripps, reverting to the agreement between the Metropolitan Electric Lighting Company and the Strand District Board, contended that there were several very substantial advantages to the consumers and to the district under the agreement which would not be present in the Provisional Order. The advantages obtained by the arrangement embodied in the agreement were: (1) A definite appropriation of the five stations as a source of light for the district. (2) A definite location of distributing mains throughout the entire district, in a position satisfactory to the local authority. (3) The security that from those stations and mains an adequate supply of electricity would be produced for the district. (4) An easy means of detecting the cause of any failure or deficiency in the supply of the district. (5) An easy means of access to headquarters situated in the district to lodge complaints and obtain remedies. (6) Definite arrangements for preventing obstructions in the streets. (7) The relief of the Board of Trade from the task of arbitrating between the local authority and the Company in regard to works in the streets. (8) Freedom of the consumer from the various onerous conditions with regard to his obtaining a supply and arbitrary powers contained in the Provisional Orders. (9) A system which augured as far as possible for a harmonious working between the local authority and the Company. All these points seemed to him to be of considerable importance; and the Strand Board claimed to have secured them by means of the arrangements they had entered into with the Company. One other important matter arising out of the agreement was the proposed periodical revision of the price to be charged. The arguments which had been put forward at the inquiry, mainly on behalf of the London Electric Lighting Corporation—although the other companies had to some extent followed the lead—about friendly competition, seemed to him to be almost too transparent to require comment, if it had not been that they appeared to have had their influence at all events with some of the vestries and parochial authorities in London. It was of special importance in regard to the Strand. The suggestion of the London Corporation he believed to be this: "Let us induce the local authority under the guise of establishing a friendly competition, to fill up the streets to their utmost capacity with their distributing mains. As soon as that is done, we shall be in the position of a happy family to combine together, and no further competition will be possible." They would thus establish a most complete form of monopoly, which could by no possibility be allowed to exist. It would cause a most absolute monopoly in the Strand if this were permitted. Against this position the District Board had endeavoured to protect the consumers in their district; and they could not have done it more effectively than by the arrangement they had made as to a periodical revision of prices at the expiration of seven years. At the same time, the District Board reserved their absolute right of consenting at any future date to any application for a Provisional Order by any other company, in the event of the Metropolitan failing to give satisfaction in the district. The arrangement for a revision of prices and for the introduction at some future time, if it was thought desirable, of another company, were two points of great security and advantage to the consumer. The London Electric Lighting Corporation still persevered, notwithstanding the dissent of the District Board, in their application for powers over the Strand district; and they presumed that if the Board of Trade felt that they could hardly have strong cause shown for overriding the decision of the local authority, they would give the Provisional Order to the Metropolitan Electric Lighting Company. If the whole of the evidence which had been given in the course of the inquiry had been laid before the Strand Board before they came to their decision, there would have been other matters which would have still further influenced them in deciding to refuse their consent to the scheme of the London Corporation. One of the principal difficulties upon which information was at an early stage sought was as to the question of rigid mains and jointing. How that matter was to be carried out had considerably puzzled the Board; and they were unable to obtain any definite information respecting it. There was nothing to show the practicability of carrying out a system of a long rigid main laid down according to the model which had been produced during the inquiry, consisting of lengths of solid copper, bolted or joined together in some manner which no one at present appeared to know anything at all about. The difficulty was one which was not likely to be overcome by any suggestion which had been submitted during the course of the inquiry. If the main was to consist of seven miles in length of pipes, and copper conductors about 21 feet each, it would follow that there must be something like 1760 joints in that main; and this was a most serious matter. It was known what an expansive and contracting power copper was; but it was not so easy to see what might be the effect of the expansion and contraction upon mains so constructed.

Mr. Pember: Are you speaking of distributing mains or trunk mains?

Mr. Cripps: I am speaking of some of the trunk mains which Lord Crawford exhibited. The advantage claimed by the London Electric Corporation was that, by having their station at Deptford, there would be less cost for coal and supervision, and that the smoke and dust would be removed from London. If it should turn out that electricity was better supplied from a distance, the London Electric Lighting Corporation had no monopoly of the system of going out of London; and if experience showed that such a change was desirable, the Metropolitan Company could very easily make arrangements and go out of London. At present the advantage rested with the Metropolitan Company. Against the reduced cost of coal and supervision, it had placed the greater length of main and the cost and possibilities of danger from jointing the pipes. With regard to the removal of smoke and dust, the District Board had taken the best possible means of ascertaining what was the value of the suggestion, and had examined with great care the stations of the London Company at Deptford and of the Metropolitan Company at Whitehall; and they had come to the conclusion that as to the latter, taking it as a sample of what they would have in London, there was really no objection of any kind. Looking to the production of 100,000 lights, which were estimated to be sufficient for all the requirements in the Strand district, it did not seem to him that the daily consumption of coal necessary for that would cause any appreciable difficulty with regard to smoke. In conclusion, he said that his Board suggested that the Board of Trade should grant a Provisional Order to the Company to which the District Board had given their consent, and refuse their consent to the Company to which the District Board had denied their consent. He did not think it necessary to prolong the inquiry by calling witnesses.

Major Marindin said he thought they ought to have someone in the box representing the Strand District Board, so that the agreement might be put in, and he could speak as to the negotiations which had taken place.

Mr. Pember: I shall have one or two serious questions to ask.

Mr. Cripps: In deference to your suggestion, I will call one of the members of the Strand District Board who has devoted a great deal of attention to this matter.

[Mr. T. H. Cole was then called by Mr. Cripps; and his evidence will be given in the Journal next week.]

DUKINFIELD LOCAL BOARD GAS SUPPLY.

The Results of the Past Year's Working.

Mr. Harrison Veevers has lately presented to the Gas Committee of the Dukinfield Local Board his report on the working of the gas undertaking during the year ending March 25 last, the results of which are very favourable. Twelve months ago, it may be remembered, the Committee resolved to reduce the price of gas from 3s. 8d. gross, and 3s. 4d. net, to 3s., with allowances of from 1d. to 5d. according to consumption, and also to let meters rent free to consumers of less than 50,000 cubic feet quarterly. The effect of these reductions has been to diminish the income from gas by £1097 6s., and meter-rents by £89 1s., or a total of £1186 7s.—equal to a reduction of 14¼ per cent. on the income from gas and meter rents. Yet, in the face of so great a reduction, Mr. Veevers is able to report that there is a surplus profit of £73 10s. 6d. Some of the causes which have led to this satisfactory conclusion will be best shown by the following table:—

	s.	d.	s.	d.	s.	d.
Cost of manufacturing and distributing gas			2	4·70	2	6·54
Less Tar	0	2·85			0	2·12
„ Sulphate	0	2·69			0	2·56
„ Coke	0	2·75			0	2·26
„ Sundries	0	0·04			0	0·06
„ Meter-rents	0	0·01			0	0·44
			0	8·34	0	7·44
			1	8·36	1	11·10
Add Annuities	0	7·31			0	7·19
„ Interest on loans	0	4·29			0	4·23
„ Sinking fund	0	1·57			0	1·36
			1	1·17	1	0·78
Average net income from gas			2	9·53	2	11·88
Present average price of gas			2	9·90	3	2·61
			0	0·37	0	2·73

From this table, it will be seen that the income from tar, sulphate of ammonia, and coke has increased, and the cost of making and selling the gas diminished. While the net cost price of gas is 1s. 8¾d., the cost of annuities, interest, and sinking fund is 1s. 1¼d. A tabulated statement of the actual amounts of increase or decrease over the previous year's accounts for each item of income and expenditure is given in the report. There was a reduction in the cost of manufacturing and distributing gas, amounting to 2¾d. per 1000 cubic feet of gas sold; and a reduction in the income from gas and meter rental of 4¼d. per 1000 feet of gas sold. But with the reduction in the price of gas, there has not singularly been any increase in the consumption. The decreased sale, in fact, has been 1,493,000 feet; and this, in the face of the reduced price, abolition of meter-rents, improved trade, and increased population, Mr. Veevers finds it difficult to explain. The report embodies a quarterly account of the manufacture, sale, and leakage of gas for the year; the totals for the twelve months being: Make, 56,782,000 cubic feet; sale, 49,210,200 feet; leakage, 7,571,800 feet; (13·33 per cent.). Mr. Veevers regards with satisfaction the reduction in the amount of unaccounted-for gas, which in the previous year was equal to 15·84 per cent., and last year was 2·51 per cent. less. This amount he hopes to still further reduce by a scheme which he is preparing for dividing the district into a high and low level. Since the works came into the sole ownership of the Board, the percentages of unaccounted-for gas have been as follows:—Year ending March, 1886, 20·82; 1887, 17·26; 1888, 15·84; 1889, 13·33. When Mr. Veevers was appointed Engineer ten years ago, the leakage was above 33 per cent. The quantity of coal and cannel carbonized in the twelve months was 5511 tons; costing on an average, delivered at the works, 11s. 5¼d. per ton. In 1887-8 the quantity was 5920 tons; costing, on an average, 11s. 4¼d. per ton. The average make of gas per ton was 10,303 cubic feet; and the sale, 8929 feet. In 1887-8 the figures were 10,177 and 8564 respectively. In 1886 the last-named item stood at 8004 feet. The plant, Mr. Veevers reports, is in good order, with the exception of the purifiers, which are chronically bad. In conclusion, Mr. Veevers recommends some improvements in the approach to the works, and also urges the necessity for new offices, the total cost of which he calculates will not exceed £1500. The accounts which accompany the report show that the total receipts amounted to £8664 18s.; and the expenditure to £5887 8s.—leaving a balance of £2777 10s. to carry to the profit and loss account. The latter shows a balance in hand of £2460 4s. 1d., against £2386 13s. 7d. at March, 1888.

The workmen employed at the Windsor Street Gas-Works of the Birmingham Corporation held their annual meeting last Thursday night, under the presidency of Mr. Charles Hunt, the Engineer of the works. The report showed that £29 6s. 10d. had been collected for the hospitals, £23 had been spent in Dispensary tickets, and £6 6s. 9d. added to the works benevolent fund. The men adopted a resolution thanking the Gas Committee and Mr. Hunt for the holidays allowed them; and also handed to the Chairman a memorial asking the Committee to let them have a mess and recreation room.

BRITISH WATER GAS SYNDICATE, LIMITED.

The Statutory Meeting of this Syndicate was held last Tuesday at the Cannon Street Hotel, E.C.—Mr. SAMSON FOX presiding.

The SECRETARY (Mr. T. H. Owens) having read the notice convening the meeting,

The CHAIRMAN addressed the shareholders at some length; referring in the first place to what had been done since the Company was floated. On April 1, he said, they offered to the public the parent Company, which was to consist of capital subscribed to the amount of £300,000. There were included in the property something like 16 to 20 patents. The capital was applied for eight times over. After a little while, they floated the Yorkshire Company with a capital of £151,000; and this was subscribed for about six times over. They then brought out the Notts. and Derby Company, with the same capital as the Yorkshire; and this was subscribed for eight times over—showing that these sub-Companies had some favour in the minds of investors. The North British Company had just been floated, with a capital of £301,000; and this was applied for ten times over. The amounts already secured to the parent Company were: For the Yorkshire Company, £101,000; Notts, £101,000; North British, £251,000—making a total of £453,000. The shareholders of the parent Company paid for the property £217,250. He said it was only right to mention that the above amounts accrued to the Company, less the sums agreed upon for promotion in each instance, as the Board, in the interest of the shareholders, had decided not to accept the risk of promoting in any case. In addition to these three Companies, they had fixed concessions which amounted to £201,000, of which £151,000 was in cash. The further contracts entered into, on which substantial deposits in cash for the carrying out of them had been paid, amounted in the aggregate to £1,000,000 sterling. Thus they had £1,000,000 in the contracts on which they had deposits, and which they had agreed to sell at certain prices offered. Then they had £201,000 on two fixed concessions, which, with the £453,000 on Companies already floated, brought out the total to £1,654,000 in six weeks of time. Speaking of the proposals of the Company, he said that on the following day they were going into the occupation of works near Glasgow, fitted with a foundry 150 feet long by 50 feet wide, and capable of making castings up to 15 tons, and fitted with turning-sheds, fitting-shops, drawing-offices, and everything required for carrying on a successful and profitable business. They intended to make all their own plant; and they would soon be able to show plant capable of making about 2000 feet per hour, night and day. As soon as the place for manufacturing the gas had been decided upon in London, they would see the evidence of water gas in some shop window. The Chairman then narrated how water gas came to be adopted at the Leeds Forge, and then spoke of some of the advantages in connection with its use for domestic purposes. From experiments made, they found that with the ordinary open hearth, solid fuel gave to the room about 3 per cent. of the heat emitted from the coal; whereas, by the use of water gas, 80 or 90 per cent. of the heat went into the room. If coal gas was used, it required ten times the amount of atmospheric air. Supposing they had 1000 cubic feet of coal gas, they must be prepared to give it 10,000 feet of atmospheric air; but if they were using water gas they had only to supply 2000 cubic feet in place of 10,000 feet. In the rooms in his house at Harrogate, and at his offices at Leeds, they burned water gas; and it was surprising what a cheery feeling he had, even after working for several hours. There was another question about the use of water gas, which he thought he should take up. It was a serious one in one respect; and it was right that people should have information upon the point. He referred to the poisonous nature of water gas. Other gases were, of course, highly charged with poison; but there were questions of degree between one and another. He believed that if they wished to be killed, and wanted to do it quickly, water gas would beat all the others. But there was a safety about the gas after all. They had discovered that water gas was perfectly safe when properly managed, and had found out how to make it smell as strongly as possible, with the result that wherever there was any leakage, if within 10 feet of it—well, they would know all about it. The Chairman then proceeded to speak of a few of the reasons why water gas must make its way generally for lighting purposes. Taking it from a commercial point of view, they all knew that it was much cheaper; it could be produced for less than 4d. per 1000 cubic feet. There were other reasons why it would succeed in large towns. It was a fixed gas. It would bear compression equal to about one ton to the square inch; it did not the first few days suffer from low temperature; and at a temperature of 200° below zero it remained a fixed gas. Now, these were conditions which made it a certainty that water gas would be used in the future almost universally. A 36-inch main, with all its attendant valves, junctions, and fittings, cost 40 times more money than a 1¼-inch; and therefore, if they could get the same result in conveying the gas for 40 times less capital, they would of course receive a much larger interest in proportion. He thought that they would yet see corporations pull up their old pipes, sell them for old metal, and put down 1¼-inch pipes for water gas in their place. Concerning the application of water gas to manufacturing purposes, he said that a most extensive examination had been made by Sir Douglas Fox; and there was hardly a point in the question that had not been dealt with in his report. This report was dated March 28, 1889; but the principal point he had to deal with was that on Feb. 20 he found that they were making gas, including interest on plant and allowing for depreciation, at 3·64d.; that on Feb. 25 they were making it at 3·35d.; and on March 20, at 3·57d., which gave an average of 3·52d. per 1000 cubic feet, interest and depreciation included. The use of water gas for the manufacture of iron and steel had shown itself to be very much in advance of gas made from any ordinary fuel. About 10,000 feet of gas could be made from a ton of coal; but the same ton of coal, when used to decompose water, would give 35,000 cubic feet of gas of a very much higher heating power. Some figures were next quoted by the Chairman showing actual results obtained in working with water gas. A puddling furnace, he said, was turning out 14 tons of puddled iron in 24 hours; whereas he had never known a furnace heated with coal to do more than 6 tons in 24 hours. A re-heater for small bars was turning out 20 tons per furnace every 24 hours; and they had nothing in this country which would do more than half that. Coal for the Siemens furnaces used to cost 8s. 6d; but now with the water-gas generator, the coal required to be used cost 5s. 6d. per ton, so that the quality of fuel might be dropped down very considerably. They used a poorer class altogether—in fact, they came down from 8s. 6d. a ton to 5s. 6d. The coal used of this 8s. 6d. quality amounted to 8·4 cwt. per ton of ingots; but of the lower quality, only 6 cwt. per ton of ingots were needed. The output of the furnace under these circumstances was, with Siemens gas, four casts every 24 hours; while water gas, with the 5s. 6d. coal, gave six casts in 24 hours. The amount of steel melting that was going on in this country at the present time was about a million tons per annum; and the largest firms of steel makers were seriously discussing this question with him (the Chairman) and those about him. Returning to the question of coal gas, it might be interesting to the shareholders to know that in this country there were 9 million tons of raw coal used for the purpose of making coal gas; and when they looked at it from a monetary point of view, bearing in mind the figures he had given, they might judge how that was to be dropped down in the future, and what the money profit would be when these changes had taken place. He had said very little about the Leeds Forge, though he ought to mention it, because it had been dealt with by the press; but he was prepared to prove that every word that had been stated by them about the advantages and increase of profit and economy resulting was true. Eight weeks ago he himself was the one individual interested in water gas in this country; to-day there were 10,000 people who either had a share in its success or failure, or had tried to have. When success came round, there was no question but that there were always those who would fain imitate; and, as they all knew, there had been within the last few days an attempt to imitate them in their success. But by whatever art or scheme such people attempted to tread in their footsteps, they would still have to make pure and cheap water gas. Nobody knew how to make it as they did—nobody had yet had any experience of the failure, trouble, and annoyance connected with getting an apparatus that could do it; and while those who had put certain statements in the newspapers asserted that they could do what the British Water Gas Syndicate could, he knew perfectly well that they could do nothing of the kind.

Mr. DUNLOP remarked that the speech of the Chairman was calculated to reduce to silence certain gentlemen who had been saying evil things about water gas, and prophesying that they would not succeed. As a commercial man, and a business man claiming to be able to understand the merits of questions plainly put before him, he was abundantly satisfied with the Chairman's speech. He had told them of no mere matters of speculation; but of the results of his own actual experience, obtained by himself and those who had used water gas on the Continent. He (the speaker) begged leave, as one of the shareholders of that fortunate Company—and it was fortunate—to express the great satisfaction with which he had listened to the Chairman's statement, and to move a vote of thanks to him for the great frankness with which he had dealt with all the matters that had been raised with respect to the gas.

Mr. J. GUEDALLA seconded the motion, and it was carried by acclamation.

The CHAIRMAN having briefly acknowledged the compliment,

The meeting was made special, for the purpose of making some alterations in the Articles of Association which were required by the Stock Exchange Committee; but they were of a merely formal character.

The proceedings then terminated.

BOLTON CORPORATION GAS SUPPLY.

ANNUAL STATEMENT—A PROSPEROUS YEAR.

At a Special Meeting of the Bolton Town Council last Wednesday—the MAYOR (Mr. Barrett) presiding—the yearly balance-sheet and accounts of the Gas Department were submitted for approval.

The adoption of the proceedings of the Gas Committee having been moved by Alderman MILES, and seconded by Mr. J. H. TOWNLEY,

Alderman MILES said he wished to refer briefly to a few of the leading features of the balance-sheet. In regard to capital, they would find that, instead of making any addition to this account (which the Committee still thought was somewhat overburdened), they had a credit of £100 for land sold. The Committee were still directing their earnest attention to the gradual reduction of the capital, and had placed £5000 as depreciation of this account, hoping that there would not be any necessity for making any very material addition to it for some little time to come. With respect to the revenue account, the gross profits amounted to the handsome figure of £47,925—a sum that had, to use a sporting phrase, again "beaten the record" of this department. After providing the usual amounts for standing charges, of annuities, interest on loans, dividend on Corporation stock, sinking fund, reserve fund, and a further special appropriation to reserve fund of £3624 13s., there remained a balance to the relief of the district rate of £12,000, which was equal to a rate of 8½d. in the pound, or to 4¼d. per 1000 cubic feet of gas sold. He trusted the members of the Council would give their sanction to this proposal. Last year, he intimated that the reduction in the price of gas then proposed, if the consumption remained stationary, would involve a loss of revenue of about £4000. The actual loss had been £4381; but this had been more than recouped by the following items:—Increased sale of gas, £1300; economy in the use of cannel, £700; improved price of coke, £450; tar, an improvement over last year of £1300; and sulphate of ammonia, £850—or a total of £4600, as against the actual loss of £4381 due to the reduction in the price of gas. There were other minor savings effected, to which it was not necessary he should allude. In the item of increased sales of gas, he confessed to a feeling of disappointment. In the previous year they sold 30 million cubic feet more gas than in the year preceding that, or an increase of 5 per cent. In the past year, with a reduction in price of 2d. per 1000 feet, they had only increased the sales by a little more than 10 millions, or 1⅔ per cent. This was partly accounted for by a brief period when the mills were working short time, and the fact that the weather during the winter was milder and generally brighter than in the former one. He believed their experience was not unique in this respect; other corporations and gas companies having a similar tale to tell. With regard to the quality of the gas supplied during the year, the daily tests at the Lum Street Gas-Works showed the illuminating power to have been 18·49 candles; at the Gas Street works, 18·63; and at the Gas Office, which was the testing-place prescribed by the Act of Parliament, 18·25 candles, compared with 17·95 in the previous year, and as against 16 candles required by the statute. The Council would remember that Mr. F. J. Bromley, the late Gas Examiner, left their employ in December last; and since that date the testing of the gas had been entrusted to Mr. W. Collins, F.C.S., whose subsequent weekly and monthly tests had fully borne out the accuracy of Mr. Bromley's previous reports, both as to illuminating power and the quality of the gas; so that, although he believed there were some members of the Council, and other persons outside, somewhat sceptical as to the accuracy of these reports, it must be admitted that there was no justification for these doubts, and he could not but think that the appointment of Mr. Collins—an absolutely impartial outside authority—should and would remove all doubts that might exist in the future. The average quantity of impurities for the year were: Sulphuretted hydrogen, *nil;* sulphur, 26·18 grains per 100 feet, a slight increase over the preceding year; and ammonia, 0·81 grain, being a considerable decrease on the same period. The amount of cannel used had, by good and careful management, again been still further reduced; being 7·96 per cent., as against 12·45 per cent. In looking through the records of the past, he found that in 1868 nothing but cannel was used in the manufacture of gas at their works; coal being first brought into use on Oct. 8, 1869. He might here state that the net cost of the gas this year per 1000 cubic feet sold—that was, taking into account all manufacturing charges, and deducting the amount received from residual products, meter charges, &c.—was the lowest on record; being 11¾d., as against 2s. 3d. in the year 1868, when cannel only was used. This figure of 11¾d. for 18¼-candle gas he believed would compare favourably with any town in Great Britain and Ireland—in fact, he had never yet seen anything to beat it. He next referred to the last paragraph but one in the Committee's report, which said: "The system of practically abolishing deposits decided upon

by the Committee promises to work satisfactorily, and had already added very considerably to their small consumers;" and he observed that more than 1200 had been added since the change came into force, and, on the approach of winter, he thought there would be a very large augmentation. He believed the change had given immense satisfaction to all the gas consumers, and had largely allayed the irritation of gas consumers at what they deemed the arbitrary system which required the officials to exact these deposits. The item of unaccounted-for gas, which was very low this year—being only 4·43 per cent.—would, he hoped, next year show a further marked improvement. He could not conclude without again expressing his belief that their staff, from the Engineer (Mr. W. Smith) downwards, were deserving of a kindly word of recognition for the manner in which their duties were discharged; and he believed that they had every reason to be well satisfied with their efforts for the successful working of the department.

Mr. BATTLE said he hoped the success of the department had not been worked out in such a manner that any of them should have cause to complain. It had been reported that the Manager had told the stokers that the Chairman or the Committee were constantly pressing upon him to enforce a burden upon them of 2 tons 6 cwt., instead of 2 tons 2 cwt., and also that they should be called upon to scurf their own retorts, which would mean four or five hours' extra work for every three men.

Mr. KIRKMAN observed that he had never heard the point raised by Mr. Battle discussed in the Committee. Calling attention to the £12,000 which it was proposed should be handed over to the district funds, he said it would be very nice for the people to read these glowing accounts; but what would they say when they saw that 2s. 8d. was being charged for what was produced at 11d.

Alderman MILES pointed out that the cost mentioned was only the bare cost of manufacture; and there were many items which had to be added. The charge was not 2s. 8d., but 2s. 6d.; and the real cost was not 11d., but 11¾d.

Mr. KIRKMAN said he was considering the principle; and he did not think it was right to charge so much more for the gas than it cost, as by that means they were playing into the hands of those who did not use gas, of whom there were large numbers. How could they expect to have the Committee exercising economy when they were having £10,000 or £12,000 handed over to them? He contended that, if what was said about water gas was true, there would be a revolution in gas supply; and they ought to be preparing for it by establishing large reserve funds.

The MAYOR thought their thanks were due to Alderman Miles for his comprehensive and lucid statement. It was satisfactory to find that, after they had paid a substantial amount to the reserve fund, they had £12,000 to hand to the district fund. He considered they were fortunate in having such a gentleman as Alderman Miles at the head of the Committee. The question raised by Mr. Kirkman had been already discussed by the Council, who decided that they should continue to pursue the present lines.

Mr. HEALY also congratulated the Chairman and Committee on the report they had presented. Had the minutes, he said, not come on so late, he was prepared to raise a discussion on the advisability of reducing the price of gas direct to the consumer. He should be glad if this question were discussed in the General Purposes Committee, because, by the course which events were taking, it would have to be considered before long. Alderman Miles did not refer to what would be a cardinal factor in the whole question of illuminants—that was, water gas, which would be a formidable competitor to coal gas. It must be remembered that water gas had reached altogether beyond the domain of experiment; and was being used in no less than 300 towns in America.

Mr. TOOTILL was afraid that if they considered the matter laid before them by Mr. Healy, they would soon have a Bolton Water Gas Syndicate. He hoped, however, that the day had not yet come.

Mr. BROUGHTON said that, after the very elaborate statement of the Chairman, he should not have ventured to have said anything that morning had it not been for the speech of Mr. Healy. There was no doubt the Chairman and Gas Committee were quite alive in regard to water gas. It appeared to him that the spirit of the South Sea bubble had not yet died out. They had had a very recent experience in electric sugar; and he did not think he should be far wrong in saying that there would be another repetition in water gas. In discussing this question of water gas, members of the Council must bear in mind that there were many systems; and it did not do for them to rush into experiments, but rather to benefit by the experiments of others. If they were to rush into these new ideas, they would, instead of having a balance of £47,000, be £47,000 on the other side; and consequently he did hope that the Council would give the members of the Gas Committee credit that, whilst having their eyes perfectly open, they were also alive to all these things. He did not see what practical purpose would be served by referring this matter of water gas to the General Purposes Committee for discussion.

Mr. TONG, referring to the remarks of Mr. Healy upon water gas, called attention to the following paragraph in the abstract of the Gas Committee's proceedings:—"The question of the production of water gas was discussed; and the further consideration thereof deferred—the Engineer to obtain as much information thereon as possible." This, he thought, was proof that the Committee were alive to the question. As to the statement of Mr. Kirkman about the large profits made upon the gas undertaking, and what might result by the introduction of water gas, he did not at the same time tell them of the sums placed to the credit of the capital and sinking fund accounts. Last year the sum of £30,000 was placed to the reduction of the capital account, and another £5000 was transferred from reserve fund account to capital account. Upon the question of charging consumers of gas a price by which an immense profit—as Mr. Kirkman put it—was made, he said it must not be forgotten that they had consumers living outside the borough who would participate in this reduction. There was an effort being made to include the out-townships in the borough boundaries, and all the townships named were opposed to it. Then why, he asked, should they give these people the benefit of a reduced price. If they were to have a great depreciation upon the gas-works, the ratepayers in those townships would not do anything towards meeting it. He was not prepared, as a ratepayer in the borough, to give the out-townships the benefit of a reduction in price.

Alderman MILES, in replying upon the discussion, said he was afraid Mr. Healy took too glowing an outlook upon water gas. He supposed he would have them believe that there was something very material in water gas. Well, he (Alderman Miles) was not prepared to say much about it; and for the present he reserved his judgment. Reference had been made to the fact that the Committee were alive to the question, and had had it under consideration, as would be seen from the paragraph read by Mr. Tong. The Committee were getting all the information possible upon the point; and he promised that they would make the best possible use of it when obtained. He had down on his notes the words "electric sugar frauds," and which had been referred to by Mr. Broughton. He asked how many people were gulled by that. He would also call their attention to a leading article which recently appeared in the JOURNAL OF GAS LIGHTING upon this water gas question. These people had no monopoly in patents or were biased in any way; and in the article he referred to (which was well worth reading), it was stated that these water gas concerns were in the hands of gigantic speculators on the Stock Exchange, and by-and-by there would come a great crash. Some would come out with pockets lined with gold, whilst many thousands more would be *minus* perhaps the whole of their money. It was said that if some great financiers were to say that they could have bottled moonlight, the British public would be gulled into believing that they would carry it about with them. As to Mr. Kirkman's observations, he denied that there were many thousands in the borough who did not use gas; adding that, in this connection, Bolton stood in the forefront, nearly the whole of the ratepayers being consumers.

The minutes were then approved.

GERMAN CONTINENTAL GAS COMPANY.

THE THIRTY-FOURTH ANNUAL REPORT OF THE DIRECTORS.

The following is an abstract (translated) of the report of the Directors of this Company for the year ending Dec. 31, 1888:—

The commercial year 1888 was, on the whole, more favourable to the German gas industry than the preceding year; for, owing to the increased activity in almost all other industries, the demand for gas also increased considerably. Unfortunately, however, the reverse was the case in the foreign establishments owned by the Company; and therefore the total result is a small, but very inconsiderable increase in consumption. The progress of the work of development was more satisfactory; and the most favourable sign for the future business of the Company is the extraordinary increase in the number of lights, through the introduction of new, and the enlargement of old distributing plant. During the whole 33 years of the existence of the Company, there has never been an increase even to approach it.

The financial aspect of the year was far more favourable than the position of the consumption of gas. Russian exchange had sunk to half the normal rate in March. Owing, however, to favourable circumstances, it rose with remarkable rapidity from July onwards; so that, on an average, the Warsaw rate of exchange was higher than in the previous year. The Austrian rate of exchange also advanced; as did the price of residual products. Consequently, the general balance-sheet for 1888 was, in proportion, quite satisfactory; and the profit showed an upward tendency for the first time in three years.

The competition of electric lighting did not increase to any extent worth mentioning during the past year. On the other hand, high-power gas illumination, called into existence by the competition of electricity, gained ground daily; expecially Mr. F. Siemens's inverted regenerative lamps for factory, restaurant, and shop lighting. This would be still greater if the majority of architects would give more attention to ventilation by the aid of the products of gas combustion. The central electric lighting station in Dessau, which in 1887 produced a loss, last year covered its expenses, and brought in a profit of 1602 marks. This, however, was not for furnishing light, the supply of which was still carried on at a loss, but was due to profits realized on electric installations. Leaving out of the question the Hereditary Prince's palace, which at the time was not yet inhabited, there were altogether 2022 incandescent and 46 arc lamps fitted up in Dessau, of which 1806 incandescent and 3 arc lamps were in the Ducal theatre, the Ducal castle, the Exchequer, &c. The second electrical station under the control of the Company, in Erfurt, comprises 310 incandescent and 2 arc lamps; and there was a loss of 3617·42 marks. Statistical records show in addition to the above, that in the towns illuminated by the Company, there were at the end of last year 4203 incandescent and 396 arc lamps not installed by them; therefore there were respectively 1022 and 90 more than in 1887. Of these, 303 incandescent and 25 arc lamps were driven by motors fed with gas supplied by the Company. In some of the districts (among others, M. Gladbach-Rheydt) many patrons of electric light have returned to the use of gas; adopting the Siemens lamps. In other cases, where factories have electric light plant of their own, any additions fall to the share of high-power illumination by gas. This system has more than doubled the efficiency hitherto obtained; or, in other words, an equal brilliancy is produced with less than half the consumption of gas. Consequently, the competitive power of gaslight has been strengthened to a corresponding extent.

At the Company's central works, the gas-meter department turned out 1576 new meters, and repaired 258 last year, as against 1444 new ones and 444 repaired in 1887. The department for heating and cooking apparatus developed considerably; 43 workmen being employed therein at the close of the year. The articles manufactured, especially all kinds of cooking and heating stoves, gas-ovens, &c., have become more extensively known, and will aid substantially the extension of the consumption of gas. There were 897 gas-irons, and 3145 gas-stoves of different kinds and sizes manufactured. This department of the Company's operations could not be expected to pay the first year, owing to the exceptional expenditure on new apparatus and models, on exhibitions, and on prospectuses, advertisements, &c.; but at the present time (March, 1889) it is yielding a profit. The building and working capital for both departments of the central works was at the close of last year 223,193·98 marks; and the profit amounted to 10,437·16 marks, or 4·68 per cent.

The insurance fund rose to 138,512·20 marks last year; and there was not any withdrawn. The disbursements for pensions, gratuities, insurance against accidents, sickness, &c., amounted to 57,496·56 marks, as compared with 38,714·31 marks in 1887. The officers' pension fund rose from 164,711·51 to 199,656·70 marks. Owing to the vigilance and care of the Company's *employés* there were no accidents in working, nor any exceptional losses.

The consumption of gas during the year 1888 was as follows:—

		Cubic Metres,	or	Per Cent.
Street lighting		5,397,804	„	19·01
Public buildings		2,195,790	„	7·70
Private houses		11,014,425	„	38·79
Industrial purposes		7,481,028		26·34
Heating purposes—				
Gas-engines	1,309,638			
Stoves, &c.	1,007,391			
		2,317,029	„	8·16
Total		28,396,076	„	100·00

Under the head "Industrial purposes," railways, cotton industries, and iron and steel works consumed respectively 2,364,571, 1,665,590, and 1,058,424 cubic metres. The falling off in the private consumption in Warsaw, Hagen, and Lemberg amounted to 611,851 cubic metres; moreover, public buildings have used 80,521 cubic metres less. But against this there was an increased consumption of 284,484 cubic metres in factories, of 318,056 cubic metres in street lighting, and of 374,575 cubic metres for heating and motive power; making a total increased consumption of 284,743 cubic metres. It is noteworthy that the consumption of gas for heating and motive power rose from 6·9 per cent. of the total in 1887, to 8·16 per cent. of the total in 1888—an increase which puts the effect of electric competition quite in the shade. At present there are 378 gas-engines in use, representing 1332-horse power against 329, representing 1133-horse power, at the close of 1887.

Turning now to the reports from the different stations of the Company, the following table shows the total production of gas at each of them:—

Station.	Production. Cubic Metres.	Production compared with 1887.	Number of Lights, 1888.	Number of Lights compared with 1887.
Frankfort-on-the-Oder	1,717,240	+ 72,000	18,323	+ 464
Potsdam-Neuendorf	2,308,015	+116,538	23,405	+ 834
Dessau	1,490,130	+130,840	17,252	+1392
Luckenwalde	649,558	+ 55,542	6,822	+ 636
M. Gladbach-Rheydt-Odenkirchen	4,294,710	+251,910	50,842	+4953
Hagen-Herdeck-Haspe	802,090	−832,840	7,435	+ 340
Warsaw-Praga	13,795,404	− 95,764	103,152	+4301
Erfurt	2,563,302	+ 70,984	21,642	+1436
Nordhausen	881,539	+ 34,144	11,570	+ 602
Lemberg	1,049,180	− 21,281	9,481	+ 272
Gotha	989,615	+ 62,489	12,557	+1196
Ruhrort	969,670	+ 36,220	6,707	+ 331
Herbesthal	91,994	+ 5,523	852	+ 42

Total production of gas: 1887, 29,784,092 cubic metres; 1888, 30,142,397 cubic metres—Increase, 358,295 cubic metres, or 1·20 per cent. Total number of lights: 1887, 272,782; 1888, 289,541—increase, 16,759, or 6·14 per cent.

At Frankfort-on-the-Oder the increase was greater than the previous year; and at Potsdam-Neuendorf it was, with the exception of the years 1874 and 1884, the greatest ever observed. At M. Gladbach a similarly large increase was registered; the other two years being 1884 and 1887. At this station the large consumption was due to the activity of the cotton industry. The number of lights was also the highest ever reached; and large business was done in gas-fittings and heating and cooking apparatus. At Dessau the increase was the same as in the previous year; and now that the last stages of the reduction in price, &c., introduced by the new lighting contract have been passed, it is hoped that the expected increased consumption will soon make matters right. At Hagen the falling off is owing to competition from the municipal gas-works in the town; and in the outlying districts there was a consumption of 419,258 cubic metres, representing an increase of 64,018 cubic metres, or 18 per cent. In those districts, too, 825 lights were fitted, whilst 485 lights were lost in the town; thus making the increase only 340 lights. At Warsaw things were very bad at first, to about the middle of the year; and in one quarter the decrease in production amounted to 228,304 cubic metres. But, owing to a more satisfactory state of politics, and to the increase in the rate of exchange, business generally improved, and the gas consumption along with it; so that the above deficit was greatly reduced. Profits were also increased by better prices being obtained for residual products; but, on the other hand, workshop profits showed considerable reduction. The most important event of the business year was the opening of the new gas-works on the 6th of October. At present there are in operation twelve settings of eight retorts, which are intended to work regularly the whole year through. The works have been constructed under the special directions of Herr Kemper. The whole, as planned, is calculated to produce annually 28,315,000 cubic metres (1000 million cubic feet); and it will be completed as required by the increase in the consumption. The finished portion of the installation includes 18 of the 96 projected furnaces, one of the four sets of apparatus, and one of the three gasholders, which are each to be of 31,000 cubic metres capacity. The works are situated quite close to the Warsaw-Vienna goods station; and all parts are connected with both the European and Russian tracks. They thus have a great advantage over the old works, which required the conveyance of coal, and the removal of coke, by carts. The old works will gradually be made to supplement the new ones. The building account of the new works stood at Rs. 1,381,853·33½ on Dec. 31, 1888. The increase in the number of lights was double that of the year 1887; and the consumption of gas for heating and for motive-power made favourable progress. Gas-engines increased to the extent of not less than 66-horse power. The naphtha-lamp competition perceptibly increased last year; but it diminished as soon as an improvement in trade set in. The increase at Erfurt has assumed its previous average, after the exceptional increments of the two previous years. The greater part of the increase is due to gas-engines, of which 11 new ones have been put up, with a total of 35½-horse power. The consumption of gas for heating and motive power at this station has already reached 18 per cent. of the total quantity sold, and will rise still higher. At Nordhausen the increase was only half as much as in the preceding year; the straitened condition of the brandy distillery impeding any great progress. In Lemberg a satisfactory augmentation during the first half of the year was followed by an extraordinary falling off, which was partly due to the introduction of a new kind of petroleum lamp. This competition is very sharp at first, but soon exhausts itself; and at present, even in Lemberg, it ought to come to a standstill. The repeated heavy advance in duty diminished the profits; on the other hand, a rise in the exchange from 160·5 to 164 corresponds to a profit of 3349·66 marks. In Gotha the consumption of gas made very good progress last year; the increase being greater on only two occasions—viz.,1876 and 1885—but in no year has there been so large an addition to the number of lights. The consumption of gas for heating and motive power purposes has also grown considerably; and now amounts to 13 per cent. of the total supply. In view of this increase continuing, steps have been taken to enlarge the works; and the work will be completed in the course of the present year. In Ruhrort, instead of the previous year's decrease, there was a satisfactory increase; and in Herbesthal a new contract was entered into with the Directors of the Royal Railway, extending to March 31, 1904.

With the exception of 1879, the total increase per cent. last year was the smallest since the foundation of the Company; the blame being due to Warsaw, Hagen, and Lemberg. The average consumption of gas per light for the year fell from 101·9 to 101·2 cubic metres, owing to the influence of Warsaw. The street lights, however, each consumed 437·7 against 424·5 cubic metres; but private consumption fell from 88 to 85·7 cubic metres per light.

The consumption of coal was divided among the following classes:—

	Hectolitres.		Per Cent.
Upper Silesian	536,720	or	42·30
Westphalian	507,993	,,	40·03
English	83,319	,,	6·57
Lower Silesian	71,119	,,	5·60
Moravian	52,727	,,	4·16
Zwickau	14,340	,,	1·13
Various kinds	2,623	,,	0·21
Total	1,268,782	,,	100·00

The increased consumption of coal amounted to 8950 hectolitres. The gas yielded per hectolitre last year was 23·8, against 23·5 cubic metres in 1887. The price of coal at all the stations, with the exception of Warsaw and Erfurt, was about the same as in the preceding year. The Russian coal duty amounted, on an average, to 1·36 marks (about 1s. 4½d.) per hectolitre, or 6 pfennig (0.6d.) higher than the year before; and the price of gas in Warsaw was raised 10 kopeck (3½d.) per 1000 feet.

The price of coke rose from 68 to 73 pfennig (about 8½d. to 9d.) per hectolitre, due to improvement in trade. This good result was, however, not only due to higher prices being obtained for smelting, coke but also to the unceasing efforts of the Company to introduce into private houses small coke and stoves suitable for its consumption. The disposal of the tar brought in 24,643·53 marks more than in 1887; and the ammonia products showed an increase of 14,935·65 marks.

The length of the mains at the close of last year was 602,400 metres, against 580,770 metres at the corresponding period of 1887.

In spite of the various misfortunes already alluded to, the profit and loss account shows a profit of 2,256,644·03 marks, or 194,033·46 marks more than in the year 1887; whilst in the general balance there is a clear profit of 1,868,156·27 marks, or 121,829·91 marks more than in the previous year. The profit allowed of the declaration of a 10½ per cent. dividend, in addition to the statutory allotment of 5 per cent. to the special reserve fund; but the Directors suggested the division of only 10 per cent., the addition of 75,000 marks to the renewal fund, the placing of 10 per cent., or 186,315·33 marks, to the special reserve fund, and the carrying over of 13,121·94 marks to the new account. Under these arrangements, the funds of the Company would be as follows at the beginning of this year:—

	Marks.
Reserve fund	1,500,000·00
Special reserve fund	299,737·18
Insurance fund	128,512·20
Renewal fund	313,736·14
	2,242,005·47

The outlook for the current year is favourable, even if that uncertain factor, the Russian exchange, which is now 25 marks higher than last year's average, is left out of the question. The month of January showed an increase of 140,652 cubic metres in the consumption of gas, which represents 39 per cent. of the total augmentation in the past year.

THE JEYPORE OIL-GAS WORKS.

We have received a copy of the report and accounts of the above-named undertaking (to which reference has been made at various times in the JOURNAL) for the year ending Dec. 31, 1888. The report was prepared by the Acting Superintendent (Mr. A. Tellery), in the absence, on leave, of Mr. S. J. Tellery, the Superintendent, to whom we have been indebted for the particulars we have been able to furnish in regard to these works, which, as may be remembered, were originally started for the production of gas from castor oil for the supply of the Maharajah's palace and the Government establishments, and have since been extended to meet the wants of private consumers. The report now to hand shows that during the past year there was expended in the manufacture and supply of gas a total sum of Rs. 57,947; but as there was a revenue of Rs. 5369, the amount actually laid out was only Rs. 52,578. The figures for the preceding year were Rs. 66,601, Rs. 7579, and Rs. 59,022. The principal item of expenditure was for the production of gas and the maintenance and alteration of the works. This amounted last year to Rs. 33,849, of which Rs. 21,318 were for 3529½ cases of kerosine oil, and Rs. 6326 for maintenance of apparatus, tar-tank work, and new oven work. There is an electric light plant on the establishment, which cost last year Rs. 119 for light supplied on festivals. Turning to the revenue, the gas sold produced Rs. 1954; the sale of products realized Rs. 1061; and the refuse material, Rs. 206. Of course, the revenue is purely nominal; very little of it being for gas sold. In fact, the report states that it was never intended by the Durbar to make the gas-works pay for themselves, though the Superintendent is sure this could be done. The report contains the following detailed statement of the cost of gas per 1000 cubic feet last year as compared with 1887:—

	1887. R.	A.	P.		1888. R.	A.	P.
Oil	5	6	6½	..	8	2	11½
Fuel	1	13	11½	..	2	8	2
Maintenance of apparatus	1	1	7½	..	1	1	4½
Purification	0	0	6½	..	0	2	2½
Miscellaneous	0	0	4½	..	0	0	4½
Labour	0	5	9	..	0	6	4½
Total cost per 1000 cubic feet	8	12	9½	..	12	5	6
Less for bye-products sold	0	3	8	..	0	7	2½
Actual cost	8	9	1½	..	11	14	3½

The gas cost last year 3r. 5a. 2½p. per 1000 cubic feet more than in the preceding twelve months, out of which 2r. 12a. 5½p. is accounted for by the greater cost of oil, and the custom duty levied by the Durbar as from the 1st of June, 1887. A further sum is attributable to the defective state of the purifying apparatus, which gave continual trouble from choking; necessitating the stoppage of manufacture while repairs were effected. The Superintendent proposed some time ago to renew and increase the apparatus, as it was not equal to requirements; but the Durbar would not consent. The proposal has, however, since been renewed by the Acting Superintendent, who, at the date of his report, hoped soon to obtain the necessary sanction, as if it were not given the results would, he said, be serious in the future; the gasholder capacity as well as the purifying plant being quite inadequate. The quantity of gas made last year was 2,604,000 cubic feet, as compared with 2,858,040 cubic feet in 1887. The average number of jets lighted daily was 579; the time each jet was kept burning being about 5 hrs. 22 mins. The average number of jets lighted is slightly below that for 1887; but the time of burning is in excess. There were 47 new lights put up last year. The loss by leakage was 145,412 cubic feet, or about 5·5 per cent. of the make; being 6·4 per cent. less than in the preceding year. This saving, which is represented by Rs. 1988, is due to certain alterations in the distributing plant, so as to allow of gas being supplied to the Residency gasholders only during the night. The Acting Superintendent concludes his report by again referring to the folly of the Durbar in refusing to carry out the necessary extensions and improvements in the works, to which his attention has been so repeatedly directed, as the condition of the purifying plant prevents better working results being shown. He adds his testimony to the efficiency with which the staff discharged their duties during the year.

THE EXPENDITURE ON THE VYRNWY WATER-WORKS.—The return of expenditure on the Vyrnwy Water-Works of the Liverpool Corporation for the three months ending March 31 last shows that there has been an outlay on the Llanwddyn embankment and works connected with the reservoir of £6922, making a total of £513,289; on quarrying at Llanwddyn, £2517, making a total of £188,323; on the pipe-line, £20,805, making the total £905,119; and on land and easements, £1046, making a total of £278,907. The entire expenditure of the quarter reached £31,291; and, adding £14,797 as the cost of maintaining the Vyrnwy estate, and £647 14s. as the cost to date of return of the Vyrnwy Hotel, the report shows a grand total expenditure on the works up to March 31 of £1,901,084.

YORKSHIRE COAL-OWNERS AND GAS COAL CONTRACTS.

Our Yorkshire Correspondent writes: "In the present unsettled state of the Yorkshire coal trade, nothing is giving rise to so much interest as the placing of the contracts for the supply of coal for the ensuing year, none of which are more important than those relating to gas coal. The interest evinced in the placing of the contracts was never perhaps before equalled. The men are looking forward to the result with a view of enforcing their demands for an advance of wages; whilst the masters point out that their only chance of meeting the men's demands is to be drawn from the increased revenue derived from the new contracts. The contracts for locomotive steam coal are being sought to be placed at 2s. per ton increase; and it is said a like attempt is to be made with respect to gas coal. The increased revenue derived from the sale of locomotive coal, as proposed, is put down at £1,000,000 sterling. An equally large revenue would, in the event of a 2s. per ton increase being put upon gas coal, be effected. Already there are an unusually large number of contracts for gas coal advertised for, many of which have to be tendered for before the close of the present month. Some of the tenders have been sent in, and others must follow in the course of the present week. The placing of the contracts this year has occurred at a curious time—viz., in the very week when the men have to decide whether they will come out on strike or accept the masters' offer. Such being the case, it is important that both coal-owners and those in charge of gas-works should calmly consider the position. Although a great deal is being made respecting the men's position, and they being bound by the decisions of the Nottingham conference, there is every prospect that matters will be arranged without a strike. Too much stress cannot be laid upon the fact that the contracts for gas and locomotive coal are about the only sources of revenue which coal-owners have now to rely upon. Merchants' and other contracts are in many places discarded for those relating to gas and locomotive coal. In the event of gas coal being unduly increased in prices, it is to be feared that managers of gas companies will have to recoup themselves from increases in the charges for gas, which, in these days of keen competition, might be found to be exceedingly difficult."

METROPOLIS WATER SUPPLY.

The returns furnished to the Registrar-General by the London Water Companies show that the average quantity of water supplied daily to the Metropolis during the past month was 156,329,633 gallons, against 153,608,044 gallons in 1888. The number of houses served last month was 749,655, or 209 gallons per house, and 26·7 gallons per head of the population; corresponding with the quantity supplied during April, 1888. Of the entire bulk of water sent out last month, 77,497,914 gallons were drawn from the Thames, and 78,831,719 gallons from the Lea and other sources.

In his report to the Registrar-General on the quality of the Metropolitan Water Supply last month, Dr. Edward Frankland remarks: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·4; Tottenham, 1·2; New River, 1·4; Colne Valley, 1·5; Grand Junction, 1·8; Lambeth, 2·3; Southwark, 2·6; East London, 3·0; and Chelsea and West Middlesex, 3·3. Of the Thames water, that sent out by the Grand Junction Company was again distinguished by its comparatively high degree of organic purity; while the waters delivered by the Chelsea and West Middlesex Companies, though of better quality than last month, contained nearly twice as much organic matter. All these waters were efficiently filtered before delivery. Of the water chiefly drawn from the River Lea, that supplied by the New River Company was of better quality than the best of the Thames waters; while that derived by the East London Company contained nearly as much organic matter as the worst of the Thames waters. Both waters were efficiently filtered by the respective Companies. The deep-well waters of the Kent and Colne Valley Companies and of the Tottenham Local Board of Health were, as usual, of a high degree of organic purity; the Kent Company's water being especially distinguished in this respect. The Colne Valley Company's waters were softened before delivery, and were thus rendered suitable for washing. These waters require no filtration. They were clear and bright."

The Proposed Extension of the Darwen Water-Works.—The negotiations for the sale by the Blackburn Corporation of the Daisy Green and Pickup Bank reservoirs to the Darwen Corporation are still proceeding. The sum asked in the first instance for the reservoirs was £100,000; but as the Sub-Committee of the Darwen Corporation intimated that this was too high a figure, it was reduced to £70,000. The Darwen people, however, mention a much less sum; and there the matter rests at present.

Stockton and Middlesbrough Water Supply.—The financial statement of the Stockton and Middlesbrough Water Board for the half year ending Feb. 14 has been published; and it shows a capital expenditure for the six months of £32,290; bringing up the total cost of the undertaking to £1,271,029. The amount received on capital account during the same period was £36,000; making the total £1,279,094, which is £8065 in excess of the amount expended. The revenue account shows the income to have been £28,757—an increase of £410, as compared with the preceding half year. The expenditure on the revenue account amounted to £6880 for the half year. Since the last report the works at Hury and Sadberge reservoirs had made satisfactory progress; and the latter will be ready for use in the course of the current month. The demand for water for manufacturing purposes continues to increase; and it is stated that there appears to be no reason to doubt that the improvement of the trade of the district will cause the demand to continue to grow.

The New Prestwich Reservoir of the Manchester Corporation.—The construction of the new service reservoir at Prestwich, in connection with the Thirlmere water scheme of the Manchester Corporation, is being energetically continued. It is only since the beginning of this year that the contractors, Messrs. Kirk and Knight, of Sleaford, commenced operations on the ground; but they have already made a fair start with the work, which, at the earliest, will not be completed until 1891. The new reservoir is being constructed side by side with the old, which is connected with the Woodhead system of supply, and will be of the same extent—4½ acres. A greater depth—extending to 40 feet—will, however, give the new reservoir a capacity of about 23 million gallons, or about three million gallons more than its neighbour. The floor will be of concrete 12 inches thick, and faced with 3-inch bricks. About 500 tons of pipes of 36 inches diameter have already been delivered at the works, to be used for bringing the water from the main to the reservoir. It will first be received by an inlet well; flowing thence over a weir into the reservoir itself. The proximity of the two reservoirs will be taken advantage of to connect them by an overflow arrangement, in order to render the supply in one available for the other when this is found to be desirable.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

Edinburgh, *Saturday.*

The Edinburgh and Leith Gas Commissioners' financial year closed on Wednesday; and although I am not yet able to give the figures, I am informed that the year has been a most successful one. The output of gas has been greater than ever; and the surplus on the working may be expected to show exceedingly well. It is not likely that the year which has just begun will end quite so satisfactorily so far as finance is concerned, because of the increase in the price of coal. The Works Committee have accepted tenders for coal which are in all cases higher than last year; the rise in some instances being more than 1s. 6d. per ton. Parrot coal, for instance, has risen from 16s. 1d. to 18s. This, it is believed, is owing to there being a large demand from London for this coal. The average rise for the coal to be supplied to the Edinburgh works—over a dozen varieties—is 10½d. per ton; and this, too, in face of the fact that, owing to improvements in the works, a cheaper class of coal can be employed. For the Leith works, with the same quality of coal as last year, the rise is even greater.

The Perth Gas Commission closed its working year on April 30; and the course of business again indicates that Mr. Whimster was not too soon in having the works extended. The output of gas in the twelve months was 79,681,100 cubic feet, or 1,658,000 cubic feet more than in the preceding year. The quantity of coal carbonized was 7560 tons; and the average yield of gas of 28·8-candle power was 10,539 cubic feet. In regard to the new works, it may here be mentioned that to meet the cost, which is estimated at £16,000, a loan of £8000 at 3½ per cent. has been obtained from the Life Association of Scotland. The loan is repayable in eight yearly instalments of £1000 each. A loan by a private gentleman of £4000 for ten years at 3½ per cent., has been renewed; and the remaining £4000 has been obtained on loan from the Perth Infirmary, for 16 years, also at 3½ per cent.

The Arbroath Gas Corporation have accepted the following tenders for coal:—Cannel coal: Newbattle, 22s. 7½d. per ton (150 to 200 tons required); Balbarden, 19s. 7½d. (300 to 500 tons required). Scotch coal: W. Salmond and Son, 9s. 3d. (300 tons); J. and W. Scott, 9s. 3d. (300 tons). The improvement in the value of secondary products was well illustrated by the offers sent in. The present price is 2s. 7d. per 100 gallons. There were five offers, ranging from 3s. to 4s. 6d. for one year. Messrs. Dobbie and Sons, Leith, offered 3s. 6d. for one year, but 5s. for a three years' lease, and 6s. for a five years' term, in which latter case they would erect permanent works in the town. Their alternative offer was supported by most of the members; but there was opposition in favour of a Glasgow firm, which had offered highest for one year, so that the matter has to be considered by a full meeting of the Board.

The Gas Committee of the Peterhead Town Council are showing a commendable desire to accommodate the public in two important directions. In the first place, it is complained by the working class that, with only two collections a year, their account for gas for the winter half year is larger than they are able to pay. It is therefore proposed, on the recommendation of the Gas Manager (Mr. J. Mackay), that there should be three collections annually—in January, May, and October. This, it is expected, will make it easier for small consumers to meet the accounts; and thus lead to more gas being burned. It is also proposed, in conjunction with this step, that, on account of the consumers' bills being less, the amount of deposit be reduced from £1 to 10s., which will further popularize gas lighting. Not content with pushing business among the lower classes, the Committee also make a proposal which should have the effect of increasing the quantity of gas taken by the upper class of citizens. Like other managers, Mr. Mackay is vexed at seeing so much valuable plant lying idle in summer; and he has made the suggestion—made, it is true, times without number by other managers, who have only been less fortunate in not being able to carry their Committee along with them—that gas should be supplied during the summer months for cooking purposes at a cheaper rate. From the 15th of April to the 15th of September, it is recommended, gas of from 21 to 23 candle power should be supplied, through special meters, at 3s. 9d. per 1000 cubic feet. It is calculated that this will meet the cost of coals, labour, wear and tear of plant, and interest on the extra services required; so that the public will get the gas at cost price. The basis of the calculation is that gas to the value of £1 7s. will be obtained from a ton of coals. In submitting the recommendations of the Committee to the Town Council on Monday night, Provost Smith said they were put forward for ventilation; and he asked that the subject should be sent back to them for further consideration. The Councillors regarded the proposals very favourably, and acceded to the Provost's request. Everyone must admire the business-like way in which the Council has gone to work over these reforms, which are likely to prove no less beneficial to the Committee than to the community.

Gasholders are not objects of art, as every reader of Ruskin knows; and gas authorities have frequently trouble in getting them put down, on account of the æsthetic objections of adjoining proprietors. There were objections at Portobello this week, when the Gas Company applied to the Dean of Guild Court for permission to erect a new holder of 150,000 cubic feet capacity; but these were not by any means on the ground that the artistic feeling of the community would be outraged. This could hardly be in the west end of Portobello, which is about as uninviting a place as one may see anywhere—at least in Scotland. It was objected that the holder would be "offensive to the occupiers" of adjoining houses, and that they would "not be safe from danger of explosion." Presumably the objectors were under the delusion that a gasholder would be the source of disagreeable odours; and they manifestly believe in the possibility of a gasholder exploding. The Bench were not deceived by the specious complaints of the objectors; but, having heard Mr. Vass, the Secretary and Manager of the Gas Company, explain that there would be no danger, they granted the application.

I omitted to mention a fortnight ago the death, which occurred on the 5th inst., of Mr. George J. Blaikie, the Chief Inspector in the Gas-Meter Testing Department in Edinburgh. Mr. Blaikie very satisfactorily filled the post for seven or eight years. The Magistrates have this week appointed Mr. Jack, Foreman in the employment of Messrs. R. Laidlaw and Son, to succeed him.

(FROM OUR GLASGOW CORRESPONDENT.)

Glasgow, *Saturday.*

An extraordinary general meeting of the shareholders of the Partick, Hillhead, and Maryhill Gas Company, Limited, was held in Glasgow last Tuesday, for the purpose of confirming the resolution come to on the 23rd of April. Mr. Henry Cowan, Chairman of the Company, occupied the chair. Mr. John Graham, C.A., the Secretary of the Company, read the resolution, which was to the effect that the Directors be authorized to issue debenture stock or annuities to the extent of £80,000 (being the present borrowing powers conferred on them by the shareholders), at a rate of interest not exceeding 4 per cent. per annum in perpetuity; and that the amount may from time to time be increased to an extent not exceeding £20,000 by an ordinary resolution of the shareholders passed at

any general meeting. On the motion of the Chairman, seconded by ex. Provost King, the resolution was unanimously approved of.

The confidence in the condition of the Partick Company which has been inspired by the confirmation of the resolution just referred to, has been reflected on the Stock Exchange this week. Business was done in the Company's stock on Tuesday (the day of the meeting) at 91s. 6d. per share; but on Thursday there were transactions reported at 93s., 94s. 6d., and 95s. per share. Yesterday, 97s. 6d. per share was wanted by holders; but no business was reported at that advance. By way of supplement to what I said on a former occasion regarding extensions which it had been resolved to make on the Company's works, I may here remark that the present intention is to extend the retort-house, so as to provide accommodation for 112 additional retorts, which will be erected as soon as possible.

At a special meeting of Coatbridge Town Council held on Thursday, the Town Clerk submitted a report of the award which had been made by two arbitrators in the dispute between the Gas Company and the Council as to the number of meters to be used in the street lamps, and the quantity of gas consumed during the first three months of the present year. The arbitrators to whom the matters in dispute were remitted were Mr. Samuel Stewart, Engineer of the Corporation Gas-Works, Greenock, for the Gas Company; and Mr. J. C. Adamson, Gas Engineer, of Airdrie, for the Town Council. Their award was as follows:—"The arbitrators, having considered the whole process and proceedings, propose to find as follows—viz. (1) That there should be provided and fixed one meter to every 15, and one meter additional to any proportion over the multiple of 15, of the public lamps; thus, taking the number of lamps at present in use at 458, the number of meters required would be 30 for 450 lamps, and one meter for the 8 lamps in excess, it being understood that the meters shall be fairly distributed throughout the lighting area of the burgh. (2) That the total quantity of gas consumed by these lamps from the 31st of December till the 31st of March last was 1,013,670 cubic feet; and, further, the arbitrators propose to find that the expense of the arbitration shall be paid by the parties equally. In the event of either party desiring to be heard against these proposed findings, the arbitrators appoint intimation in writing to be made to the Clerk within ten days from this date. *Note.*—The arbitrators recommend that the index of the meters be taken jointly by a representative of the Gas Company and of the Town Council at short intervals (say every week), so that any irregularity in any meter would at once be detected and rectified." The Town Clerk subsequently explained that before the reference was gone into, the Lighting Committee offered to affix meters to 26 of the lamps, and that the Gas Company determined on having the reference, with the result that some additional meters had to be put in. The Company required one meter for every ten lamps, which, said Mr. Sharp, would have made 46 meters or thereabouts, as compared with 31 according to the award of the arbitrators.

A successful exhibition of gas cooking-stoves and other appliances for household use was opened at Stirling last Tuesday. A local firm of plumbers, Messrs. G. Chisholm and Son, were the chief agents in getting up the exhibition; and they called to their aid Messrs. R. and A. Main, of Glasgow, Messrs. J. Wright and Co., of Birmingham, and Messrs. J. Milne and Son, of Edinburgh. The Glasgow and Birmingham firms had on view a great variety of cooking-stoves, of all sizes and capacities, from artizan and bachelcr stoves to the large kitchener, complete with hood, hot-plate, and hot water boiler, for family and hotel use. In connection with the exhibition, Miss Burden, of the Glasgow School of Cookery, gave some interesting demonstrations in cookery by the use of gas-stoves. The exhibition and the cookery demonstrations were continued throughout the week. I ought to remark that Dr. Galbraith, Chairman of the Stirling Gaslight Company, with which he has been connected during the long period of twenty years, opened the exhibition, delivering a most interesting and instructive address.

The ordinary monthly meeting of the Renfrew Town Council was held on Monday evening. The minutes of a special meeting of the Council held on April 22, stated that, in reply to a communication asking if they could supply Renfrew with gas, a letter was read from the Paisley Gas Corporation, stating that the cost of the necessary pipe, station meter, &c., would be about £5000. The Council, after considering the matter, resolved that in view of the large apparent outlay necessary to obtain a supply of gas from Paisley, it was inexpedient to proceed further in the matter. It may be remembered that within the past few years a similar overture was made to the Glasgow Corporation Gas Committee by the Renfrew Town Council, but without any good effect.

A Clydebank paragraph in a Dunbartonshire paper says: "We hear that there is some doubt as to whether the Glasgow Corporation will grant a supply of gas to Dalmuir." I think I may say with confidence that so far as the proposal has been under the consideration of the Glasgow Corporation Gas Committee, there is no doubt at all; indeed, the proposal has not been entertained. The Glasgow gas is supplied to Clydebank proper; and at the same price as is charged in Glasgow and the immediate suburbs—the gas-rents being collected by the servants of the Gas Trust in the usual way. But the resolution to embrace Clydebank proper in the ordinary area of supply came about by a sort of "fluke." Messrs. J. and G. Thomson, the chief employers of labour in Clydebank (which is, indeed, practically a community of their own creation), possessed gas-works in their great shipyard, which they expressed their willingness to discontinue if the Glasgow gas authorities would consent to extend their pipes to the district and take up the supply to the householders. This they agreed to do, partly in consideration of the fact that Messrs. Thomson, through their very extensive engine-works, were large consumers of gas within the city. But this extension has been a cause of regret almost ever since, as the selling of gas in Clydebank has been attended with a loss to the Gas Trust; and Messrs. Thomson have long since given up their connection with Glasgow altogether in the way of requiring gas—their engine-works being now almost located at Clydebank. If there has been a loss hitherto with Clydebank, still greater would be the loss if the gas were to be sent on to Dalmuir, which is still farther away.

The proposed District Water Commission for Airdrie, Coatbridge, and Old Monkland has for the present fallen into abeyance; but it is expected to crop up some other time under new management.

At a meeting of the Kelso Police Commissioners on Monday, the Board had under consideration the proposed scheme of bringing by gravitation a supply of water for the town from Greenhill, near Hownam, a distance of 13 miles. The probable cost of carrying out the scheme was estimated at from £10,000 to £12,000. After considerable discussion, a resolution was agreed to that the Commissioners should proceed with the scheme, and that the resolution be laid before the ratepayers and a *plébiscite* taken as to their approval or disapproval of the scheme.

The Glasgow pig-iron warrant market has been somewhat irregular this week; and on the whole the tendency has been flat. Buyers have held the control to some extent during the past few days. Prices have declined for Scotch warrant iron from 44s. cash last Monday to 43s. 3½d. yesterday; the close in the afternoon, however, being somewhat better.

There is practically no change of any importance to report in regard to the local coal trade.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 18.

Sulphate of Ammonia.—Although the demand has been desultory, prices have been fairly maintained, and there have been none too many parcels on the market. At Hull, business has been done principally at £11 17s. 6d.; but at the close £12 is again asked. The Leith market is now firm at £11 16s. 3d. to £11 17s. 6d.; while at Liverpool sulphate is still bringing good prices, varying between £11 17s. 6d. and £12 2s. 6d. Present inquiries seem to indicate that the tone of the market is not likely to be disturbed; and the better feeling in nitrate will substantially aid an improvement as regards consumers' ideas about the future. There is very little sulphate offering, however, for future delivery; and full prices would have to be paid to induce makers to part with their prospective production.

LONDON, *May* 18.

Tar Products.—There is a conspiracy on the part of a number of middlemen who deal in pitch to "bear" that article; but distillers will be wise to remember that coal is likely to be much dearer, and that pitch fuel is sure to follow suit. Fuel makers are extremely busy here and abroad, and the use for this purpose is likely to increase rather than otherwise; the statements of the "bear" operators notwithstanding. Most of the products are fairly firm; but the week has not been marked by any important business. Prices: Tar, 20s. to 25s. per ton. Benzol, 90 per cent., 3s. 3d. per gallon; 50 per cent., 2s. 3d. per gallon. Toluol, 1s. 5d. per gallon. Solvent naphtha, 1s. 3d. per gallon. Crude naphtha (30 per cent.), 1s. 1d. per gallon. Light oil, 3½d. per gallon. Creosote, 2¼d. per gallon. Pitch, 22s. 6d. per ton. Carbolic acid (crude), 3s. 9d. per gallon. Cresylic acid, 10d. per gallon. Tar salts, 17s. 6d. per ton. Anthracene (30 per cent.), "A" quality, 1s. 3½d. per unit; "B," 1s. 1d., according to quality.

Ammonia Products.—Sulphate of ammonia is undoubtedly better, both for spot and forward delivery. Nitrate appears to have touched the bottom, and is not only improving in value, but is reflecting its better tone on the sulphate market. Large sales are reported during the week at prices varying from £11 15s. to £12 per ton. It is pleasing to observe fresh channels continuously opening up for the outlet of sulphate. This is remarkably the case at the moment, and is all the more so since nitrate has not for many years touched the figures quoted during the past week. Prices:—Gas liquor (5° Twaddel), 8s. per ton, with a rise or fall of 1s. 6d. per degree. Sulphate of ammonia, £11 15s. to £12 per ton, according to position. Liquor ammonia, 2d. per lb. Carbonate of ammonia, from 3d. to 3½d. per lb. Muriate of ammonia, brown, £19 per ton; white, £23 15s. Sal-ammoniac, £30 to £32 per ton.

ELECTRIC LIGHTING IN LEEDS.—The question of lighting the central part of Leeds by electricity came last Friday week before the Committee of the Corporation dealing with the subject. The Borough Engineer (Mr. T. Hewson) reported that he had received estimates and particulars from two firms for the lighting of the portion of the town named. The Borough Engineer also reported upon the expense of working the present installation owned by the Corporation. Discussion then ensued as to the number of persons who were likely to take advantage of illumination by means of the electric light, the probable cost to such persons, and other similar matters. Finally, Mr. Hewson was instructed to report to a future meeting upon the comparative cost of systems based upon the supply of light, in the area specified, by arc or by incandescent lamps.

SEVILLE WATER-WORKS COMPANY, LIMITED.—The ordinary meeting of this Company was held last Thursday week. The Chairman (Mr. E. Horner), in moving the adoption of the report and accounts, said that the accounts of a Company like theirs were rather peculiar, inasmuch as they were not themselves working the concern. They had, as the shareholders knew, leased the works to Messrs. Easton and Anderson for five years, four of which had expired. The consequence was the accounts did not show any working expenses. At their last meeting he called attention to the fact that there had been an increase in the number of persons supplied of 778, compared with the previous year. This year there had been a further increase of 472. That was to say there had been an increase of more than 1000 consumers in the two years—showing that the Company was really progressing. The total sum received up to March 31 last was £23,092, against £20,378 in the previous year; so that they were advancing, and they might hope, by the time the contract was out, that there would be a still further increase. He did not anticipate that there would be any difficulty in paying their dividend when they worked the concern themselves. The motion was agreed to; and a dividend for the half year at the rate of 5 per cent. per annum was then declared. This will absorb £6685 10s., and leave £10,331 to be carried forward.

HASTINGS WATER SUPPLY.—As briefly intimated in the JOURNAL for the 7th inst., Mr. P. H. Palmer, Assoc. M. Inst. C.E., the Borough Surveyor of Hastings, read a paper on the water supply of the district, in connection with the Health Congress recently held in that town. He enumerated the sources of water supply; and said the total estimated daily yield was 1,285,800 gallons of soft water. The total quantity of water pumped during the year is about 353 million gallons, which works out to a total of about 18 to 20 gallons per head of the population. Hastings was also supplied with a constant service of salt water, and nearly the whole of the streets in the borough are watered therewith. There are only a few of the hotels and private residences which have salt-water services, and these are, by degrees, being disused by the consumers, owing to the great cost of keeping in repair the fittings, which are soon rendered useless and unworkable owing to the corrosive action of the salt. The water supply to the town is at present quite adequate for all requirements, and the water is of good quality. It is desirable that the town should have a constant, and not an intermittent supply; but Mr. Palmer thought the chances of increasing the supply to any large extent from additional headings or new wells in this district are not to be relied upon, in consequence of the numerous faults occurring in the strata, which is not a good water-bearing one. There are numerous instances in Hastings of deep wells and bore-holes which, owing to faults, have entirely failed. It may, therefore, be said that there is no very great encouragement to sink wells with any idea of getting sufficient water for the requirements of a population such as Hastings will probably contain in ten years' time. With regard to future supplies from a distance, Mr. Palmer said the Wealden district is not well suited for large storeage reservoirs and gravitation works, because so much of the land is cultivated. Glynde is 21½ miles from Hastings, in a direct line. The engineering difficulties in conveying water from that place would be slight; and the summit levels between Glynde and Hastings are less than 100 feet. No doubt water of a somewhat similar quality could be obtained a little nearer Hastings—say, near Berwick; but the probability is that the yield would not be nearly so great as at Glynde. Mr. Palmer added that he had not touched upon the sources of supply from the chalk formation; but there was little doubt that a copious supply could be obtained in the neighbourhood of Bishopstone or Jevington. He was of opinion, however, that whatever source might be decided upon in the future, preference should be given to a reasonably soft water to that of hard chalk water.

SEVENOAKS WATER SUPPLY.—The Sevenoaks Rural Sanitary Authority have been in communication with the Kent Water Company for an extension of their mains to Otford. Mr. A. Dickson, the Company's Secretary, has informed the Authority that the extension would cost £2000; and the charge for the supply of water would be on the annual rental of the premises served, and for flushing sewers at the rate of 10d. per 1000 gallons. The Authority have decided not to agree to the Company's terms; and an alternative plan for the supply of water to the district is to be considered.

THE DIFFERENTIAL GAS-RATE AT SALFORD.—Another meeting of the representatives of local authorities and private consumers situated within the area of the Salford gas supply was held at the Victoria Hotel, Manchester, last Tuesday afternoon. The Secretary (Mr. G. Trenbath) read a letter from the Town Clerk of Salford, dated the 4th inst., stating that the Gas Committee had had under consideration the question of the differential rate, and did not feel justified in making any alteration; but they promised to favourably consider the question in March, 1890. As the result of a long discussion, a resolution was passed that a deputation again wait upon the Committee, and request them to intimate their intention to forthwith abolish the rate, in which event the conference would be prepared to await the carrying into effect of the abolition until March, 1890. The question of taking legal proceedings to restrain the Corporation from appropriating the £79,000 wrongly accumulated in respect of the depreciation fund was postponed until after the interview of the deputation with the Committee.

EXTENSION OF THE BOLTON WATER-WORKS.—At the Bolton Town Hall, last Tuesday, an inquiry was held by Mr. S. J. Smith, C.E., one of the Local Government Board Inspectors, with reference to the application made by the Corporation for power to borrow £80,000 for an extension of the works connected with their water undertaking. The Town Clerk (Mr. R. G. Hinnell) explained that the application was made under an amendment of the Local Act of 1883. The Corporation had authority to borrow £100,000; but they now applied for power to borrow an additional £80,000, the period of repayment not to exceed 60 years. The works proposed were a reservoir at High Rid, the Heaton filter-beds, improvements to the Entwisle reservoir, a water tunnel at Sharples, a water-main from Egerton to the Sweetloves reservoir, the improvement of the brooks supplying the Wayoh reservoir, and the extension of the mains in the Corporation's water limits. They had entered into contracts for the principal portions of the works; and balances had been retained for contingencies. After some further details had been given by the Water Engineer (Mr. Swindlehurst, M. Inst. C.E.), the inquiry terminated.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.—The report of the Directors of this Company for the past year, which will be presented to the shareholders at the annual general meeting on the 28th inst., states that the volume of business shows a marked increase over previous years; the receipts for gas being 31·28 per cent. greater than those of 1887, whilst from private consumption they are 86·19 per cent. over those of 1886. In consequence of the increasing demand for gas, it was found necessary to further extend the radius of the Company's mains. About 34 miles of new pipes were therefore laid, and the erection and completion of the additions to the works, referred to at the last general meeting, for improving the capacity of supply have also been proceeded with. These consist mainly in the erection of a new retort-house, an additional station meter, condensers, washers, exhausters, boilers, &c. Mr. G. E. Stevenson having retired from the service of the Company, Mr. Lewis T. Wright (late Engineer and Manager of the Nottingham Corporation Gas-Works) was appointed Engineer and General Manager. The charge of the works was taken over by him in October last; and under his supervision and direction, the alterations and improvements are being carried out. The profit for the year amounts, at the par of Exchange, to £101,103; and there was brought forward from 1887 £6979—making a total of £108,082. From this has to be deducted the debenture interest, the amounts written off on the balance of reorganization of mains account and for new purifiers, and the loss in exchange—in all £68,100—leaving a balance of £39,982. The Directors recommend that the dividend for the year be at the rate of 8 per cent. (free of income-tax), 3 per cent. of which has already been distributed; leaving 5 per cent. to be paid in respect of the last six months of the year. This will leave a balance of about £10,727, out of which the Directors recommend that £2000 be carried to the reserve, thereby increasing it to £56,254, and a bonus of 4s. per share be paid upon the old shares of the Company, and 2s. per share upon the new issue, leaving £1166 to be carried forward. This bonus will raise the total amount paid on the shares to a sum equal to 10 per cent. per annum. In view of the increasing business of the Company, and the very large capital expenditure thereby entailed, the Directors have determined very shortly to issue the balance of the authorized capital.

THE WARWICK GAS COMPANY AND "MODERN LEGISLATION."—In a recent issue of the *Warwick Gazette*, a writer, signing himself "Expert," says that there is nothing more noticeable, in glancing over the annual returns issued by the Board of Trade relating to gas undertakings than how a few companies have persistently kept outside the current of modern legislation, and have succeeded in shaping their course in such a way as to escape the statutory restrictions which the want of new capital usually affords an opportunity of imposing on companies. Among these "outcasts" the Warwick gas undertaking, he remarks, certainly occupies a prominent if not a unique position. This Company was incorporated as far back as the year 1822, with a share capital of £15,000; and it is really a matter for wonder how they have succeeded in keeping out of Parliament for a period of 67 years. Hume's parliamentary return (1850) quotes the price of gas at Warwick in the years 1847, 1848, and 1849 at 10s., 9s., and 8s. per 1000 cubic feet; the price of coal at 20s. per ton; and the Company's dividends at 6 per cent. Moor's parliamentary returns (1865) give the price of gas at Warwick at 7s. in 1851; the price of coal at 15s.; and the dividends at 6 per cent. A parliamentary return (Captain Gridley's) of 1865 states the price of gas at 4s. 6d.; coals at 15s. 1d.; and the dividends at 10 per cent. The earliest Board of Trade return furnishes the results for the year 1880, from which it appears that the price in that year was 4s. 3d., with a discount of 6d.; and the sale of gas amounted to 33,865,600 cubic feet. In that return the dividend is not recorded. But in the following year 10 per cent. and 5 per cent. bonus is mentioned; and this has been ever since the stereotyped form through which the Directors convey that they annually divide 15 per cent. upon the original capital of an undertaking that seems prosperous, for the sale of gas had risen in 1887 to 45,305,400 cubic feet, with the price at 3s. 4d., and a discount of 4d. There is probably, says "Expert," no limitation to dividend whatever; but it will be easily understood, he continues, "that a Company which has pursued the policy of keeping outside all statutory restrictions for considerably over half a century offers a most unusual opportunity to the Local Authority for securing, upon a carefully-conducted transfer, a very great bargain indeed for the ratepayers. This is a matter which ought to attract the attention of the far-seeing members of the Town Council; for the opportunities are indeed very rare of securing an undertaking upon terms which promise so considerable a return to the ratepayers."

THE FINANCES OF THE BOLTON CORPORATION WATER DEPARTMENT.—The accounts of the Bolton Water-Works Committee for the year ending March 31 last have been published; and they show that the income amounted in twelve months to £48,058, against £49,381 for the previous year. There was an increased demand for water for domestic and trade purposes; but Leigh and Hindley largely reduced their supply, the building and "casuals" supplies were considerably diminished, and the fittings trade profits fell nearly £300. On the other hand, the expenditure was £37,772, against £37,460 14s.; the sum of £1286 was transferred to renewal fund, against £1920 6s. 9d.; and profit to the extent of £9000 was transferred to the borough fund, against £10,000 last year. The increased expenditure was due to advanced salaries, maintenance of works, sinking fund charges, rates and taxes, and interest; but, on the other hand, rents and rent-charges fell from £2731 to £1244.

MIDDLETON CORPORATION GAS SUPPLY.—Yesterday week, Mr. C. L. Hartley, the Gas Manager, presented to the Corporation of Middleton his annual report on the gas undertaking. It showed that the profit on the year's working amounted to £1183 8s. 7½d. The gas made was 71,540,000 cubic feet—an increase of 2,449,000 cubic feet over the previous year. The gas sold amounted to 62,772,600 cubic feet—an increase of 3,818,300 cubic feet; and the leakage for the year was 10·78, against 13·03, or a saving of 2·25. The coal and cannel carbonized was 6888 tons, in the proportion of 77·65 per cent. of coal and 23·35 of cannel; as against 75·74 per cent. of coal and 24·26 of cannel. The coke made is estimated at 4477 tons, of which 63 per cent. was used for the furnaces, and 37 per cent. sold. The tar and liquor produced amounted to 460 tons of tar and 755 tons of liquor; and the net proceeds of the coke, tar, and liquor came to 36 per cent. on the cost of the coal and cannel, as against 30 per cent. in the preceding year. The working of the sulphate plant has resulted in a net profit of £173 15s. 3d.—an increase of £34 1s.; and the whole of the capital charge for the plant has now been written off. The sale of gas, less discounts, amounted to £10,322; and rental of meters and stoves to £470, with 15s. transfer fees. These make a total revenue of £10,792, as against £11,334, or a decrease of £542, which is accounted for by the reduced price of gas this year. The gross profit amounts to £5476 15s. 1½d. Out of this the interest and sinking fund and annuities absorb £4292 6s. 6d., equal to 16·41d. per 1000 cubic feet of gas sold; leaving a net profit, as before stated, of £1183 8s. 7½d., or about £202 less than last year. Had the price of gas remained unaltered, the profit for the year would have amounted to £2428, or £1043 more than last year. The Town Council decided to increase the salary of the Gas Manager by £30 per annum. A vote of thanks was given to the Chairman of the Gas Committee for the very satisfactory result of the year's working of the Gas Department.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For STOCK MARKET INTELLIGENCE, see *ante*, p. 944.)

Issue.	Share	When ex. Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	11 Apr.	10½	Alliance & Dublin 10 p. c.	10	18½—19½	..	5 7 8
100,000	10	„	7½	Do. 7 p. c.	10	13—14	..	5 7 2
800,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	100	111—113	..	4 8 6
100,000	20	29 Nov.	10	Bahia, Limited	20	24—26	..	7 18 10
200,000	5	15 May	7½	Bombay, Limited	5	7—7½*	..	5 0 0
40,000	5	„	7½	Do. New	4	5—5½*	..	5 9 1
380,000	Stck.	14 Feb.	11½	Brentford Consolidated	100	229—234	..	5 0 5
125,000	„	„	8½	Do. New	100	167—172	..	5 1 9
220,000	20	14 Mar.	10½	Brighton & Hove, Original	20	42—44	..	4 15 5
320,000	20	28 Mar.	11½	British	20	45—47	..	4 15 9
50,000	10	14 Mar.	11	Bromley, Ordinary 10 p. c.	10	20—22	..	5 0 0
39,000	10	„	8	Do. 7 p. c.	10	13½—14½	..	5 10 4
328,750	10	14 Nov.	8	Buenos Ayres (New) Limited	10	15—16	..	5 0 0
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	107—110	..	5 9 1
150,000	20	28 Feb.	8	Cagliari, Limited	20	35—37	..	5 18 6
550,000	Stck.	11 Apr.	13½	Commercial, Old Stock	100	268—273	..	5 0 8
180,000	„	„	10½	Do. New do.	100	214—219	..	5 18 2
180,000	„	28 Dec.	4½	Do. 4½ p. c. Deb. do.	100	128—128	..	3 10 3
557,320	20	13 Dec.	13	Continental Union, Limited	20	47—49	..	5 6 2
242,680	20	„	13	Do. New ·69 & ·72	14	33—34	+½	5 6 7
200,000	20	„	10	Do. 7 p. c. Pref.	20	38—40	..	5 0 0
75,000	Stck.	28 Mar.	10	Crystal Palace District	100	204—208	..	4 16 2
234,060	10	30 Jan.	13	European, Limited	10	25½—25¾	..	4 18 1
120,000	10	„	13	Do. New.	7½	17½—18½	..	5 5 3
354,060	10	„	13	Do. do.	5	12½—13½	..	4 16 3
5,468,600	Stck.	14 Feb.	13	Gaslight & Coke, A, Ordinary	100	260—264	+8	4 18 6
100,000	„	„	4	Do. B, 4 p. c. max.	100	100—105	..	3 16 3
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	+2	3 15 6
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	128—128	..	3 18 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	182—187	..	4 0 2
1,300,000	„	„	7	Do. H, 7 p. c. max.	100	169—174	+1	4 0 5
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	259—264	+2	3 15 10
1,051,150	„	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	119—122	..	3 5 7
294,850	„	„	4½	Do. 4½ p. c. do.	100	125—130	..	3 9 3
650,000	„	„	6	Do. 6 p. c. do.	100	178—177	−1½	3 7 10
3,600,000	Stck.	15 May	10	Imperial Continental	100	210–214*	+2	4 18 5
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd	5	5—5½	..	5 9 1
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—115	..	4 6 11
541,920	20	29 Nov.	6	Monte Video, Limited	20	18½—19½	..	6 3 1
150,000	5	29 Nov.	10	Oriental, Limited	5	9½—10	..	5 0 0
60,000	5	28 Mar.	7	Ottoman, Limited	5	6½—6¾	..	5 3 8
166,870	10	16 Jan.	4	Paré, Limited	10	5½—6	..	6 13 4
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	101—105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	95—100	..	6 0 0
100,000	10	26 Apr.	10	San Paulo, Limited	10	16—17	..	5 17 8
500,000	Stck.	28 Feb.	16½	South Metropolitan, A Stock	100	317—322	..	5 0 11
1,350,000	„	„	19½	Do. B do.	100	241—246	..	4 18 7
141,500	„	„	18½	Do. C do.	100	260—270	..	4 18 1
600,000	„	28 Dec.	5	Do. 5 p. c. Deb. Stk.	100	137—140	..	3 11 5
60,000	5	28 Feb.	11½	Tottenham & Edm'ntn, Orig.	5	11—13	..	4 8 5
						*Ex div		
				WATER COMPANIES.				
717,467	Stck.	28 Dec.	9	Chelsea, Ordinary	100	260—265	+3	3 7 11
1,730,560	Stck.	11 Apr.	7½	East London, Ordinary	100	204—208	..	3 13 1
700,000	50	13 Dec.	9	Grand Junction.	50	122—126	..	3 11 5
708,000	Stck.	14 Feb.	10½	Kent	100	272—277	..	3 15 9
1,043,800	100	28 Dec.	9	Lambeth, 10 p. c. max.	100	250—255	..	3 10 7
406,200	100	„	7½	Do. 7½ p. c. max.	100	199—204	..	3 13 6
200,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	118—120	..	3 6 8
500,000	100	14 Feb.	12½	New River, New Shares	100	348—353	..	3 8 8
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	100	126—129	+1	3 2 0
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	174—179	−1	3 7 0
126,500	100	„	6	Do. 7½ p. c. do.	100	162—167	..	3 11 10
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	264—269	..	3 14 4

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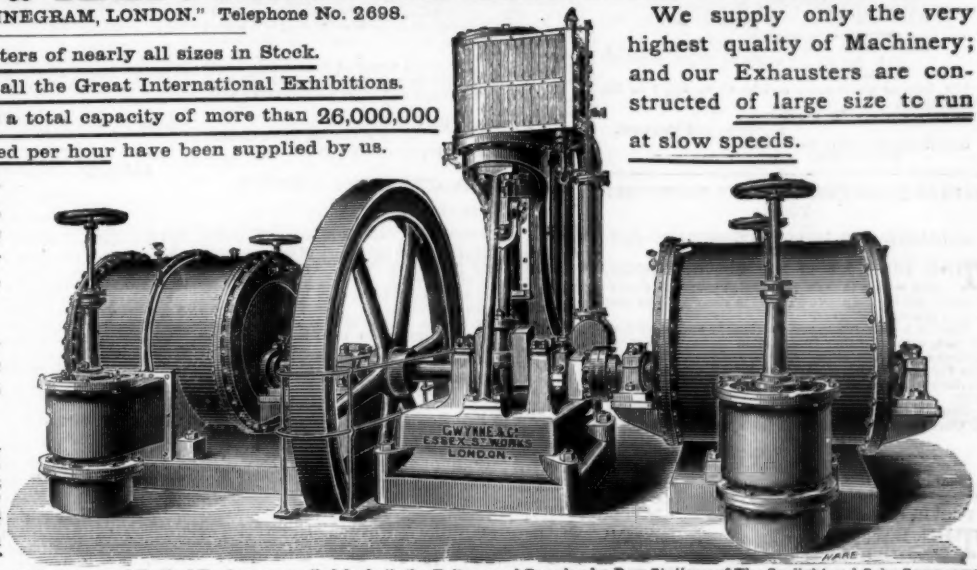


Exhausters and Vertical Engine as supplied for both the Fulham and Bromley-by-Bow Stations of The Gaslight and Coke Company.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

ANDREW STEPHENSON, Agent for the GAS PURIFICATION AND CHEMICAL COMPANY, Limited, Palmerston Buildings, Old Broad Street, LONDON, E.C.

CANNEL COAL, &c.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, / No. 54, BERNARD STREET, LEITH, } SCOTLAND.

INCANDESCENT Gas-Lamps. Standards, Brackets, Gaseliers.—The NEW INCANDESCENT GAS-LIGHT (unbreakable Metal Mantles) can now be supplied. Burners, complete for ordinary fittings, from 10s. 6d. Standards for table, complete with Mantle, &c., from 20s. 31, HIGH HOLBORN, W.C.

ADVERTISER, aged 22, seeks Engagement as GAS MANAGER or MANAGER and SECRETARY in Works making from 5 to 15 millions per Annum. Eight years' practical experience in Works making 20 millions. First-class references and testimonials.
Address, R. G., care of R. SHADBOLT, Gas-Works, Fleetwood, LANCASHIRE.

THE Advertiser, an Associate Member of the Institute of Civil Engineers, having had an extensive commercial experience, and personally well-known to British Engineers and Gas Managers, is desirous of negotiating with firms of repute for their sole representation in London and District for the following Goods and Manufactures:—
Gas Coal and Cannel,
Meters,
Fire-Bricks and Retorts,
Gas Apparatus,
Cast-Iron Mains,
Lead Tubing,
Cast-Iron Tubes,
Hydraulic Machinery,
And all Goods incidental to the Manufacture and Distribution of Gas.
Speciality, to create Foreign Business through London Houses.
Communications will be treated with the strictest confidence.
Address No. 1709, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Re-engagement as WORKING MANAGER, where the make is from 8 to 12 millions per Annum. Understands the Manufacture and Distribution of Gas by all the latest Improvements. In present situation over 20 years. Good character.
Address No. 1700, care of Mr. King 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a small Works in Hants, a LIVESEY WASHER to pass 100,000 feet per Day. Also One PURIFIER, 7 feet square; must be in good condition.
All particulars to No. 1710, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TIMMIS & CO., of STOURBRIDGE Make only the best quality of FIRE-CLAY RETORTS, BRICKS, TILES, & LUMPS. Also SPECIAL SILICA BRICKS, to stand great heats. All descriptions kept in Stock.
For Prices apply to JAMES LAWRIE AND CO. 1, Whittington Avenue, Leadenhall Street, E.C., Sole Agents for London and District.
Telegraphic Address: "EIRWAL, LONDON."

ALEX. WRIGHT & Co., 55, 55a, and 56, MILLBANK STREET, LONDON, S.W.
[Telegraphic Address: "PRECISION LONDON."]
Makers of Wet and Dry Gas-Meters. Station Meters and Governors, Photometers, and Gas-Testing Apparatus, Test Gasholders and Meters, Registering and other Gauges, &c., &c.
*** See Advertisement on Page III. of the Wrapper of this week's issue.

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 888 of last week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award. Melbourne Exhibition, 1889, for Wet and Dry Gas-Meters, Station Meters, and Governors, Pressure-Gauges, Street Lamps, and Pillars, &c.
Telegraphic Address: "Braddock, Oldham."

FORCED DRAUGHT.

MELDRUM BROS., Engineers, of 26, Half Street, Cathedral Yard, Manchester, are prepared to Supply and Fix to any ordinary Boiler Furnace complete APPARATUS for burning Breeze, Coal Dust, or other small or poor Fuel. Results guaranteed. Terms on application.

WANTED, a sober industrious Man as STOKER, &c., in a Country Gas-Works; one able to do a little rough Fitting and Service Laying preferred.
Address MANAGER, GAS-WORKS, OAKHAM.

WANTED, a few Tank-Waggons—new or good second-hand—to hold from 2000 to 2300 gallons each.
Address, stating price, &c., No. 1701, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED—Any Gas Company having for Sale one LIVESEY WASHER, and one KIRKHAM'S SCRUBBER for 500,000 feet per day, will please communicate with Mr. LONGWORTH, Gas Offices, GUILDFORD.

FOR SALE—Four Purifiers, 16. ft by 12 ft. by 3 ft. 9 in. deep inside, with 12-inch Centre-Valve (Walker's) and Connections. Practically equal to new. Would erect complete.
Also Four PURIFIERS 12 ft. by 6 ft. 9 in. by 3 ft. deep inside, with 10 inch Centre-Valve and Connections. Do.
Also One Cast-Iron SCRUBBER 40 ft. high by 10 ft. diameter.
Also One Cast-Iron SCRUBBER 24 ft. high by 10 ft. diameter.
Inquiries invited for various second-hand Gas Plant—Gasholders, Tanks, Purifiers, Washers, Exhausters, Station Meters, &c.
Apply to SAML. WHILE (late Ashmore and While), 60, Queen Victoria Street, LONDON, E.C.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID for making SULPHATE OF AMMONIA of high quality and colour.
Highest References and all particulars supplied on application.

SULPHATE of Ammonia Lead Work and Fittings. Lead Burner. Tanks and Saturators made and repaired on the shortest notice
Address P. J. DAVIES, 78, Earl's Court Road, Kensington, LONDON.

FOR SALE—A 5000 cubic feet per hour ROTARY EXHAUSTER, in thorough good order. Being removed for a larger one. May be seen working up to the middle of June on application to the Resident Foreman.
Apply to the GAS-WORKS, Uxbridge, MIDDLESEX.

FOR SALE—Two Purifiers, 12 ft. by 6 ft. by 3 ft. 6 in. deep (inside measurement). Complete with Covers, three tiers of Bars and Sieves for each, two 8 inch Four-way Cocks and Centre-Pipes; also STATION METER (by J. Milne and Son) to pass 6000 cubic feet per hour, with Bye-Pass arrangement.
JESSE WALL,
Manager and Secretary.
Gas-Works, St. Andrews, N.B.,
April, 1889.

FOR SALE—A good Second-hand Station METER, in Ornamental Square Case, to pass 12,000 cubic feet per hour, with 10-inch Valves and Connections. Can be seen at work by applying to Mr. J. Niven, Secretary and Manager, Clayton, Allerton, and Thornton Gas-Works, near Bradford.
For price and particulars, apply to THE GAS-METER COMPANY, LIMITED, Union Street, OLDHAM; or 238, Kingsland Road, LONDON.

SOUTH METROPOLITAN GAS STOCK, PRESENTING A SOUND INVESTMENT.
BY ORDER OF THE EXECUTORS OF THE LATE W. BROWN, ESQ.

MR. G. A. WILKINSON will Sell by Auction, at the Mart, on Monday, May 27, at One, in Lots, £2300 "B" STOCK in the SOUTH METROPOLITAN GAS COMPANY, paying a Dividend of £12 2s. 6d. Per Cent.
Particulars of Messrs. MARCHANT AND BENWELL, Solicitors, 8, George Yard, LOMBARD STREET, and Broadway, DEPTFORD; and of Mr. G. A. WILKINSON Land Agent and Auctioneer, 7, Poultry, CITY.

Next Stock and Share Auction, Wednesday, May 22, at 2.30 o'clock, by

MESSRS. EDWIN FOX & BOUSFIELD, in well-established Undertakings, as follows:—
EPSOM and EWELL GAS COMPANY.—100 £25 Ordinary Shares, fully-paid; Dividend, 8 Per Cent.
NORTHFLEET and GREENHITHE GAS COMPANY, Limited.—£800 "A" Stock; Dividend, 11 Per Cent.
WEST KENT GAS COMPANY.—40 £10 Shares (fully paid), paying Maximum Dividend of 10 Per Cent.
GRAYS GAS COMPANY.—£10 Ordinary "B" Shares; Dividend last Half Year, £4 18s. Per Cent.; Maximum Dividend, 7 Per Cent.
Catalogues may be obtained at the MART, and of Messrs. EDWIN FOX AND BOUSFIELD, 99, Gresham Street, BANK, E.C.

CORPORATION OF LONGTON.

GASHOLDER, ETC., FOR SALE.

THE Gas Committee have the following Plant FOR SALE (in good condition), and are prepared to receive OFFERS for the same:—

GASHOLDER 60 feet diameter and 23 feet deep, and Framework.

CAST-IRON VERTICAL CONDENSER, suitable for a daily make of 250,000 to 300,000 cubic feet.

For further particulars and to view, apply to the undersigned.

W. W. HULSE,
Secretary and Manager.

Gas-Works, Longton, Staffordshire,
May 11, 1889.

SALE OF £30,000 FOUR PER CENT. DEBENTURE STOCK.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company give notice that they will be prepared to receive TENDERS for the above STOCK in sums not less than £25 or Multiples thereof.

Printed tender forms and particulars and conditions of sale, with all other information necessary, can be had on application to the Secretary of the Company, at the Company's Offices, D'Olier Street, Dublin, or will be forwarded to any part of the Country on application.

Tenders must be delivered at the Company's Offices, D'Olier Street, on or before Tuesday, the 28th inst.

By order,
W. F. COTTON,
Secretary and Manager.

Board-Room, D'Olier Street, May 1, 1889.

YEOVIL GAS AND COKE COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for the supply of 1000, 2000, or 3000 tons of good GAS COAL, delivered free at the Town Station, L. & S. W. R., at Yeovil, in such quantities as may be required by the Manager, for One year, commencing on the 1st of July next.

Parties tendering to state prices in Owner's and Colliery wagons.

Tenders by the 27th inst.

No tender necessarily accepted.

EDWARD HOWELL, Manager.

Gas-Works, Yeovil, May 14, 1889.

THE Directors of the Swindon Gas and Coke Company, Limited, are prepared to receive TENDERS for the supply of 700 to 1400 tons of best screened GAS COAL, delivered free at Swindon G. W. Railway Station, in such quantities as required, for the period of One year, commencing the 1st of July next.

Tenders, endorsed, and addressed to the undersigned, to be sent in not later than Saturday, June 1.

The Directors do not bind themselves to accept the lowest or any tender. No forms of tender provided.

By order,
H. C. SHEPHERD,
Manager and Secretary.

Gas Offices, Cricklade Road,
Swindon.

TO LIME MASTERS.

THE Corporation of Walsall are ready to receive TENDERS for the supply of about 500 tons of LIME that will be required at their Gas-Works during One year from the 1st of July next; the deliveries to be in such monthly quantities as the Manager of the Gas-Works may from time to time direct.

The Lime is to be hand-picked, and clear from Refuse and Ashes, and to be delivered at Walsall Railway Station, or by boat at Walsall Old or New Gas-Works. In the latter case it will have to be unloaded.

Payments monthly.

Tenders, sealed and marked outside "Tender for Lime," are to be sent to the undersigned on or before Friday, the 31st of May inst.

JOHN R. COOPER, Town Clerk.

Borough Offices, Walsall, May 16, 1889.

TENDERS FOR TAR.

THE Corporation of Walsall are ready to receive TENDERS from persons willing to purchase the surplus TAR made at their Old and New Gas-Works during One year from the 1st of July next. The Corporation will deliver it into the Contractor's Boats at the Gas-Works. Not more than two boat-loads will be allowed to remain in the Tanks at each Gas-Works at any time. The price per quantity of 210 gallons to be stated. To be paid for monthly.

Tenders, sealed and marked outside "Tender for Tar," are to be sent to me on or before Friday, the 31st of May inst.

Security will have to be given for the performance of the contract.

JOHN R. COOPER, Town Clerk.

Borough Offices, Walsall, May 16, 1889.

TENDERS FOR GAS COAL.

THE Corporation of Walsall invite TENDERS for the supply of 28,000 tons of STAVELEY, YORKSHIRE, or any other good GAS COAL, to be delivered during One year from the 1st of July next, either at the London and North-Western or Midland Railway Stations at Walsall, or the Corporation Siding at the Pleck Gas-Works, as may be required.

Forms of tender and specification may be obtained on application to the undersigned.

The Corporation do not bind themselves to accept any tender; and they reserve the right to divide the contract between several firms.

Tenders, sealed and marked outside "Tender for Gas Coal," and stating the price for large Coal and also for Nuts, are to be sent to the undersigned on or before Friday, the 31st of May inst.

JOHN R. COOPER, Town Clerk.

Borough Offices, Walsall, May 16, 1889.

CITY OF MANCHESTER.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive, on or before the 23rd of May next, OFFERS of high-class CANNELS and COALS, suitable for Gas Making, for delivery at their Gaythorn, Rochdale Road, and Bradford Road Works, during a period of One, Two, or Three years, commencing the 1st of November, 1889.

Particulars and printed forms of tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order of the Gas Committee,
JOSEPH HERON, Town Clerk.

Town Hall, Manchester, April 26, 1889.

THE PETERBOROUGH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the supply of best screened GAS COAL and NUTS, for One or Two years, commencing the 1st of July next.

Form of tender and conditions may be obtained on application to the undersigned.

Tenders to be sent in by the 10th of June, 1889, endorsed "Coal," and addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

JOHN BARTON,
Secretary and Manager.

Gas-Works, New Road,
Peterborough, May 17, 1889.

THE PETERBOROUGH GAS COMPANY.

TENDERS FOR TAR.

THE Directors of the above Company invite TENDERS for the purchase of the surplus TAR produced at their Works, for One year, commencing the 1st of July next.

Form of tender and conditions may be obtained on application to the undersigned.

Tenders to be sent in by the 10th of June, 1889, endorsed "Tar," and addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the highest or any tender.

JOHN BARTON,
Secretary and Manager.

Gas-Works, New Road,
Peterborough, May 17, 1889.

TENDERS FOR GAS COAL AND CANNEL.

THE Trustees for the District and Harbour of Maryport are prepared to receive TENDERS for the supply of CANNEL and best screened GAS COAL for One year, commencing on the 1st of July next, to be delivered as required at the Trustees' Vault on the Maryport and Carlisle Railway, near the Harbour.

Sealed tenders, endorsed "Tender for Coal—Gas Department," specifying the kind of Cannel or Coal, and the Pits at which the same is to be raised, and quoting cash terms for monthly payments, to be sent to the undersigned not later than Saturday, the 1st prox.

The Trustees do not bind themselves to accept the lowest or any tender.

F. KELLY,
Clerk to the Trustees.

Town and Harbour Offices, Maryort,
May 15, 1889.

TENDERS FOR GAS COAL.

THE Directors of the Clayton, Allerton, and Thornton Gas Company invite TENDERS for the supply of 5000 tons of GAS COAL and NUTS COAL, also 600 tons of CANNEL, per year. The Coal to be Screened, free from Scale, Sulphurous Pyrites, or other objectionable matter, and to be delivered at the Gas-Works, Low Lane, Clayton, or at the Great Northern Railway Station, Clayton, in such quantities weekly as may be ordered by the Company's Manager, during One, Two, or Three years, as may be agreed upon. The said tenders to state the Seam and the Pit from which the Coal is intended to be sent.

Sealed tenders, endorsed "Tenders for Gas Coal," addressed to the Chairman, at the Gas-Works, to be delivered at or before Noon on Monday, the 3rd day of June, 1889.

The Directors do not pledge themselves to accept the lowest or any tender, reserving to themselves the right to divide the contracts as they may think proper.

By order,
JOHN NIVEN,
Secretary and Manager.

Gas Offices, Clayton,
near Bradford, May 14, 1889.

TO COLLIERY PROPRIETORS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for 130,000 tons of screened GAS COAL and 26,000 tons of CANNEL (not Scotch), to be delivered during Twelve months, from July 1, 1889, to June 30, 1890, as follows:—106,000 tons to be delivered at the Company's Siding at Neepsend, on the M. S. & L. Railway, and 50,000 tons to be delivered by Carts at the Effingham Street or Neepsend Works in such monthly quantities as may be required.

Tenders to state the maximum quantity the Contractors can supply.

The Directors reserve the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

Conditions and forms of tender may be obtained on application to the undersigned.

Tenders, marked "Tender for Coal," must be delivered at the Company's Offices not later than Monday, June 3, 1889.

HANBURY THOMAS,
General Manager.

Gas Company's Offices, Commercial Street,
Sheffield, May 15, 1889.

CORPORATION OF BURNLEY.

OXIDE OF IRON.

THE Gas Committee of the Burnley Corporation are prepared to receive TENDERS for the supply of 150 tons of OXIDE OF IRON for Purification. The Oxide must be delivered at Burnley either by Rail or Canal. Parties tendering will be required to furnish samples of the Oxide proposed to be supplied.

Tenders, endorsed "Tender for Oxide," and addressed to the Chairman of the Gas Committee, must be delivered at the Town Hall, Burnley, on or before the 29th of May, 1889.

WALTER SOUTHERN, Town Clerk.

Burnley, May 17, 1889.

SALFORD CORPORATION GAS-WORKS.

COAL AND CANNEL.

To COLLIERY PROPRIETORS.

THE Corporation of Salford invite Tenders for the supply of the COAL and CANNEL required at their various Gas Stations in Salford, for One, Two, or Three years.

Forms of tender, and conditions upon which only tenders will be received, may be obtained on application at my Office, Town Hall, Salford.

Tenders, endorsed, "Coal and Cannel Contract," addressed to the Chairman of the Gas Committee, to be delivered to me before Five p.m. on Thursday, the 30th inst.

By order,
SAMUEL BROWN, Town Clerk.

Town Hall, Salford, May 17, 1889.

TO COAL PROPRIETORS.

THE Gas Committee of the Huddersfield Corporation are prepared to receive TENDERS for the supply of the best quality of COAL, COAL-NUTS, CANNEL, and CANNEL NUTS, for Gas-Making purposes, for a period of One year, commencing on the 1st of August next.

Tenders, to state the price per ton delivered at the Railway Depôt, Hillhouse, or into the Gas-Works, or into Boats at the Colliery Staiths, must be sent in so as to be delivered to Mr. John Burgess, C.E., Gas Engineer, Gas Office, Leeds Road, Huddersfield, not later than Tuesday morning, the 28th of May inst., endorsed "Tender for Cannel and Coal."

Forms of tender and any further information may be obtained from the Gas Engineer.

By order,
GEORGE B. NALDER, Town Clerk.

Huddersfield, May 17, 1889.

ST. HELENS CORPORATION.

(GAS DEPARTMENT.)

TO TAR DISTILLERS.

THE Gas Committee of the Borough of St. Helens are prepared to receive OFFERS for the purchase of the surplus TAR produced at their Works for a period of One year, from the 1st of July, 1889, to the 30th of June, 1890.

Offers to be at per ton of 20 cwt., delivered into Contractor's tank-wagons at the Gas-Works Siding, St. Helens.

Quantity, about 1000 tons, more or less.

Forms of tender and all information may be obtained upon application to the undersigned.

Tenders, properly endorsed, to be delivered to the Chairman of the Gas Committee, Gas-Works, St. Helens, on or before Tuesday, the 11th of June next.

The highest or any other tender not necessarily accepted.

SAMUEL GLOVER, Manager.

Gas-Works, St. Helens, May 15, 1889.

THE SHREWSBURY GASLIGHT COMPANY.

DISPOSAL OF SURPLUS TAR.

THE Directors of the above Company are desirous of receiving TENDERS for the purchase of the surplus TAR made at their Works during the Twelve months commencing July 1, 1889.

The estimated quantity for disposal is about 750 tons per Annum.

Forms of tender, containing all further particulars, may be obtained on application at the Company's Works, or by post.

Tenders to be sent in to the undersigned not later than the 15th day of June, 1889.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WM. BELTON, Assoc. M. Inst. C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 16, 1889.

THE SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company invite TENDERS for the supply of best screened GAS COALS, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Twelve months commencing July 1, 1889.

About 10,000 tons per Annum will be required under the contract.

The Directors reserve to themselves the right to divide the quantity into two or more contracts, and do not bind themselves to accept the lowest or any tender.

Forms of tender, containing all further particulars, may be obtained on application at the Company's Works, or by post.

Tenders to be sent to the undersigned on or before the 15th day of June, 1889.

By order,
WM. BELTON, Assoc. M. Inst. C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 16, 1889.

FARNWORTH AND KEARSLEY GAS COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works, together or separately, for a term of One or Two years.

Sealed tenders, addressed to James Warburton, Esq., Chairman, and endorsed "Tender for Tar and Ammoniacal Liquor," must be delivered on or before Saturday, May 25 next.

Forms of tender, or any further information required, may be obtained from the undersigned.

THOMAS LEA SHEPPARD, Manager.

Gas Offices, Farnworth, near Bolton,
May 9, 1889.

BOROUGH OF DARWEN.

SUPPLY OF GAS COAL.

THE Corporation are prepared to receive TENDERS for the supply of about 10,000 tons per Annum of best GAS COAL (screened Cobbles and Nuts), for One, Two, or Three years.

Specification and forms of tender, with further particulars, may be obtained from Mr. Thos. Duxbury, Gas-Works Manager, Darwen.

Tenders, sealed and endorsed "Tender for Coal," to be addressed to me and delivered at my Office at or before Noon on Thursday, the 23rd of May inst.

The Corporation do not bind themselves to accept the owest or any tender.

By order,
CHAS. COSTEKER, Town Clerk.

Town Clerk's Office, Darwen,
May 6, 1889.

ULVERSTON LOCAL BOARD.

TO TAR DISTILLERS AND OTHERS.

THE Gas and Water Committee are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works, for a period of One or Two years, commencing the 1st of July next.

Information as to quantity, &c., may be had on application to the undersigned.

Sealed tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar," to be sent in not later than the 30th inst.

The Committee do not bind themselves to accept the highest or any tender.

JNO. SWAN, Engineer and Manager.

ULVERSTON LOCAL BOARD.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for the supply of CANNEL COAL for Gas purposes, to be delivered in such quantities as may be required by the Manager during a term of One or Two years, commencing July 1, 1889.

The Cannel offered must be free from all Bats, Pyrites, and Dross.

Parties tendering must give full particulars of the Cannel offered, and the name of the Colliery from which they propose to supply, and state the price per ton delivered carriage paid to Ulverston Station, or delivered free by boat at Ulverston Canal Basin.

Sealed tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Cannel," to be sent in not later than the 30th inst.

The Committee do not bind themselves to accept the lowest or any tender.

Forms of tender and further information may be obtained on application to the undersigned in writing.

JNO. SWAN, Engineer and Manager.

TENDERS FOR GAS COAL.

THE Gas Committee of the Stockton Corporation invite TENDERS for the supply, in whole or in part, of 24,000 tons of clean, well-screened or treble NUTS GAS COAL, similar in quality to sample wagon, to be supplied to the Gas Committee, if so requested.

The Coal to be delivered, free from all dues, in the Gas-Works Siding, in a dry state; free from Dirt, Shale, or other impurities, and in such daily quantities as may from time to time be directed by the Gas Manager.

Payments will be made monthly after each Council Meeting.

The Gas Committee do not bind themselves to accept the lowest or any tender.

Tenders, specifying the quantity and description of Coal offered, to be sealed and endorsed "Tender for Gas Coal," to be lodged with me on or before the 29th day of May, 1889.

WM. FORD, Manager.

Corporation Gas Works,
Stockton-on-Tees, May 6, 1889.

WINDSOR ROYAL GASLIGHT COMPANY.

SUPPLY OF GAS COALS.

THE Directors of the Windsor Royal Gaslight Company invite TENDERS for the supply of 12,500 tons of GAS COALS, to be delivered free at the Windsor Station of the Great Western Railway, such Coals to be either of the following description—viz., New Pelton, Pelaw Main, Ravensworth Pelaw, or Holmside.

The Coals to be delivered as follows—viz., April, 1890, 400 tons; May, 400 tons; June, 400 tons; July, 400 tons; August, 400 tons; September, 550 tons; October, 650 tons; November, 650tons; December, 650 tons; January, 1891, 600 tons; February, 600 tons; March, 550 tons; the same quantities for the twelve months following—the Company having the option of increasing the quantity by 50 tons in any of the months at the contract price per ton for any extra quantity so required.

The Contractor to state for which description of Coals he tenders, as none other than those specified will be received.

The Directors will not entertain any conditional tender, or be bound to accept the lowest or any tender.

Tenders to be delivered on or before Monday, the 3rd day of June, 1889, addressed to the Secretary, Gas Offices, Windsor.

By order,
GEORGE CARTLAND, Secretary.

Gas Offices, Victoria Street Windsor,
May, 1889.

WARWICK GASLIGHT COMPANY.

TO TAR DISTILLERS.

THE Committee of the Warwick Gaslight Company are desirous of receiving TENDERS for the purchase of their surplus TAR, for One or Three years, commencing July 1 next.

Tenders to be sent to the undersigned not later than June 11, 1889.

WALTER T. TEW, Manager.

Gas-Works, Warwick, May 8, 1889.

WIDNES LOCAL BOARD.

TENDERS FOR SUPPLY OF GAS COAL.

THE Widnes Local Board invite TENDERS for the supply of about 8000 tons of GAS COAL, and about 3000 tons of SLACK, to be delivered at their Gas-Works, Widnes.

Conditions and forms of tender may be obtained from Mr. Carr, Gas Engineer, Widnes.

Tenders to be addressed to the Chairman of the Gas Committee, endorsed "Gas Coal," and delivered to the undersigned not later than Ten a.m. on the 27th inst.

The Board do not bind themselves to accept the lowest or any tender.

JAS. T. ALLEN, Clerk.

Town Hall, Widnes, May 7, 1889.

TENDERS FOR GAS COAL.

THE Directors of the Slough Gas and Coke Company are prepared to receive TENDERS for the supply of 1800 to 2000 tons per annum of GAS COAL, screened or unscreened, to be delivered at the Slough Station of the Great Western Railway, during a period of One or Two years respectively from the 1st of July next, in monthly quantities as may be required.

Payment for Coals within the following month after delivery.

Tenders to be delivered to the undersigned, endorsed "Tender for Gas Coal," on or before Tuesday, the 11th day of June next.

The Directors do not bind themselves to accept the lowest or any tender.

ARTHUR THOMAS, Secretary.

High Street, Slough, Bucks.,
May 8, 1889.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Slough Gas and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR (or either) produced at their Works, for a term of One year, from the 30th of June, 1889.

The Slough Branch of the Grand Junction Canal is available.

The estimated quantities to be produced are: Tar, 20,000 gallons; and Liquor, 45,000 gallons.

Further particulars may be obtained on application to the undersigned.

Sealed tenders, stating price for Tar per barrel of 36 gallons, and prices for Ammoniacal Liquor per 1000 gallons of different strengths, at the Company's Works, and endorsed "Tender for Tar and Liquor," to be delivered on or before Tuesday, the 11th of June next.

The Directors do not bind themselves to accept the highest or any tender.

ARTHUR THOMAS, Secretary.

High Street, Slough, May 8, 1889.

TO COLLIERY PROPRIETORS AND COAL MERCHANTS.

THE Directors of the Gravesend and Milton Gaslight Company are prepared to receive TENDERS for the supply of GAS COAL for their Works, near the Canal, Gravesend.

Tenders should quote one price f.o.b.; and an alternative price alongside in the Canal Basin.

The Company pay Canal Dues.

The Company will not accept any tender which purports to deliver the Coals out of Lighters.

Every tender should quote for One and Three years, from the 25th of June, 1889.

The quantity required will probably amount to from 8000 to 10,000 tons per Annum; but the Company do not guarantee this or any other quantity.

The Directors do not bind themselves to accept the lowest or any other tender.

In the event of their accepting any tender, the successful person must sign a contract, a copy of which can be seen at my Offices, 27, King Street, Gravesend.

Tenders, sealed, and marked outside "Tenders for Coal," must be sent to my Offices on or before June 4, at Noon, addressed to the Chairman and Directors of the Gravesend and Milton Gaslight Company.

By order,
CHAS. R. GRAMSHAW, Secretary.

27, King Street, Gravesend,
May 9, 1889.

TO CHEMICAL MANUFACTURERS & OTHERS.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Gravesend and Milton Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR of the Company, from the 25th of June, 1889.

The contract will terminate on the 24th of June, 1890.

The purchaser will be required to sign a contract, a copy of which can be seen at my Offices.

The Tar and Liquor will be delivered free into the purchaser's barges alongside the Company's Works, which abut on the Thames and Medway Canal.

The purchaser must pay Canal Dues.

Tenders must quote for Tar at per gallon, and for Liquor at per ounce of Strength per butt of 108 gallons. Twaddle's Test (at 60° Fahr.) will be observed.

The Directors do not guarantee any specific quantity of Tar or Liquor; but there will probably be about from 80,000 to 100,000 gallons of Tar.

Tenders, marked outside "Tenders for Tar and Liquor," sealed, and addressed to me as below, must reach me not later than Tuesday, June 5 next.

The Directors do not bind themselves to accept the highest or any tender.

By order,
CHARLES R. GRAMSHAW, Secretary.

27, King Street, Gravesend,
May 9, 1889.

CORPORATION OF WARRINGTON.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of 12,000 tons of GAS COAL or NUTS, and 4000 tons of CANNEL, for One, Two, or Three years, from the 1st of July next.

Forms of tender and further particulars may be obtained on application to Mr. W. B. Haddock, Engineer, Gas-Works, Warrington.

Tenders, endorsed "Tender for Coal" or "Cannel," must be addressed to the Chairman of the Gas Committee, and sent in not later than the 5th of June next.

The Gas Committee do not bind themselves to accept the lowest or any tender.

FREDK. TAYLOR, Secretary.

Gas Office, Warrington, May 10, 1889.

BOROUGH OF HALIFAX.

TO MANUFACTURING CHEMISTS AND TAR DISTILLERS.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works during the year ending June 30, 1890. Delivery may take place from the Railway Siding of the Corporation Gas-Works, or from the Canal Wharf of the Calder and Hebble Navigation, with which a tar-pipe communicates.

Full particulars may be obtained on application to the Engineer, Mr. Thomas Holgate, F.C.S., Gas-Works, Halifax.

Sealed tenders, endorsed "Tar," stating the price offered per ton, and the mode of removal, to be sent to the undersigned not later than Ten a.m., on Friday, the 31st day of May, 1889.

The highest or any tender will not necessarily be accepted.

By order,
KEIGHLEY WALTON, Town Clerk.

Town Hall, Halifax, May 14, 1889.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Brighouse Local Board are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works for a term of One, Two, or Three years, from the 1st of July next.

The quantity of Tar made is about 350 tons per Annum.

The Tar can be loaded into Contractor's Carts on the Works, or into Barges on the Aire and Calder Canal (which runs alongside) by pipe direct from the Works. Any further particulars can be obtained on application to the undersigned.

Sealed tenders, endorsed on the outside "Tender for Tar," stating price per ton at the Gas-Works, must be sent in on or before Tuesday, the 4th day of June, 1889, addressed to Richard Kershaw, Esq., Chairman of the Local Board, Public Offices, Brighouse.

The Board do not bind themselves to accept the highest or any tender.

By order,
JAMES PARKINSON, Manager.

Brighouse, May 17, 1889.

UXBRIDGE AND HILLINGDON GAS CONSUMERS' COMPANY.

GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 3500 tons of GAS COAL, deliveries of which are to commence the first week of July next, and finish the last week in May, 1890.

Tenders to be made for 2000 tons of the best South Yorkshire Old Silkstone unscreened Gas Coal, delivered in Trucks, free, at the Uxbridge Railway Station, G.W.R. (21 cwt. to the ton), and for 1500 of the best description of unscreened Gas Coal from the Durham Coal Fields, delivered by barge, free, alongside the Gas Company's Works on the Grand Junction Canal.

Tenders are to state the names of the Pits from which both the above descriptions of Coal will be supplied. The Coal shall be fresh wrought, and free from Slate, Pyrites, and Impurities, and to the entire satisfaction of the Company's Engineer. Deliveries to be made according to the requirements of the Company.

Tenders to be received on or before the 8th day of June next, addressed to the Chairman, Gas Office, Uxbridge, and endorsed "Tender for Gas Coal."

No forms of tender provided.

W. & W. M. GARDINER,
Secretaries.

Uxbridge, Middlesex, May 9, 1889.

TO COAL PROPRIETORS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the supply of the best quality of screened COAL, COAL NUTS, CANNEL, and CANNEL NUTS, for Gas Making purposes, for a period of One, Two, or Three years, commencing from the 26th of June, 1889.

Forms of tender, together with any further information, may be obtained from Mr. T. O. Paterson, C.E. Gas Engineer, Gas-Works, Birkenhead.

Tenders, stating the price per ton delivered on to the Gas-Works Railway Siding, must be sent in to me, sealed and endorsed "Tender for Gas-Works Coal," not later than Five o'clock in the afternoon of Friday, the 7th of June, 1889.

Also for a supply of STEAM COAL and SLACK, to be delivered at the Pumping-Stations of the Spring Hill, Flaybrick Hill, and Borough Road Water-Works, for a period of One, Two, or Three years, commencing from the 26th of June, 1889.

Forms of tender and any other information may be obtained from Mr. W. A. Richardson, C.E., Water Engineer, Town Hall, Birkenhead.

Tenders, stating the price per ton delivered at the various Pumping-Stations, must be sent in to me, sealed and endorsed "Tender for Water-Works Coal," not later than Five o'clock in the afternoon of Friday, the 7th of June, 1889.

Deliveries to be made from time to time according to the requirements of the respective Engineers.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
ALFRED GILL, Town Clerk.

Town Hall, Birkenhead, April 29, 1889.

COAL.

THE East Dereham Local Board require TENDERS for GAS COAL, by Ten a.m., on Tuesday, June 4 next.

For particulars and form of tender apply to

B. H. Vores, Clerk.

East Dereham.

CORPORATION OF BLACKPOOL.

THE Gas Committee are prepared to receive TENDERS for the supply of COAL and CANNEL for the next Twelve months, from June 1.

Form of tender may be had on application to the undersigned.

Tenders, endorsed outside "Tender for Coal or Cannel," must be sent in, addressed to the Chairman, by the 25th of May.

By order,

John Chew, Gas Engineer.

THE MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

To the Shareholders.

NOTICE is hereby given that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 11th of June, 1889, at Twelve o'clock at Noon, for the purpose of receiving the Report of the Directors and the Accounts for the year ended the 31st of March, 1889, and for the transaction of the General Business of the Company.

One of the Directors, Charles Newton, Esq., will retire from office, but offers himself for re-election.

The Auditors, Alfred Hersee and Robert Hesketh Jones, Esqrs., will retire from office, but are eligible for re-election.

The Transfer Books will be closed from the 28th of May until the day of the meeting, both inclusive.

By order,

A. W. Cooper, Secretary.

60, Gracechurch Street, E.C.,
May 14, 1889.

MONTE VIDEO GAS COMPANY, LIMITED.

NOTICE is hereby given that the Seventeenth ORDINARY GENERAL MEETING of the Company will be held at Winchester House, Old Broad Street, London, on Friday, the 31st day of May, at Twelve o'clock, Noon, when the Directors will present a Report and an Audited Statement of Accounts for the Year ended the 31st of December, 1888.

The Books for the transfer of Shares will be closed from Monday, the 20th, to Friday, the 31st of May, 1889, both days inclusive.

Dated this 20th day of May, 1889.

By order,

Thomas F. Lane, Secretary.

Offices of the Company.
103, Gresham House, Old Broad Street,
London, E.C.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Invention may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street Westminster.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

Price 5s. per 100, post free.

The Composition and Use of Gas Lime in Agriculture.

By (the late) Dr. A. VOELCKER,

Professor of Chemistry to the Royal Agricultural Society of England.

London: Walter King, 11, Bolt Court, Fleet St., E.C.

IMPROVED RETORT SETTING.

W. G. WALLER & Co.,

RETORT SETTERS & CONTRACTORS,

Having had much experience in the Setting of Retorts, beg to call the attention of Gas Engineers and Managers to their Improved System of Setting Retorts and Tar-Furnaces.

Contractors for Building Shafts, Tanks, Retort Benches, and all other Buildings connected with Gas-Works.

Estimates on application.

The Poplars, Waddon, Croydon, Surrey.

MARQUIS OF LOTHIAN'S

NEWBATTLE CANNEL.

QUOTATIONS ON APPLICATION TO

MR. JOHN MORISON,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

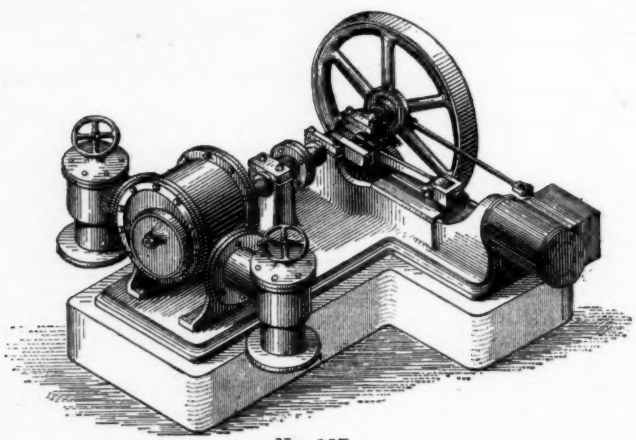
G. WALLER & Co.'s NEW PATENT GAS EXHAUSTER.

MADE WITH 4, 3, OR 2 BLADES.

In use at, or on order for, over **120** *Works, equal to* **6,840,000** *Cubic Feet per Hour.*

Oldest Makers of Beale Exhausters for over 300 Works and 25,600,000 cubic feet per hour.

1,000 to **250,000** CUBIC FEET PER HOUR WITH OR WITHOUT ENGINE COMBINED.



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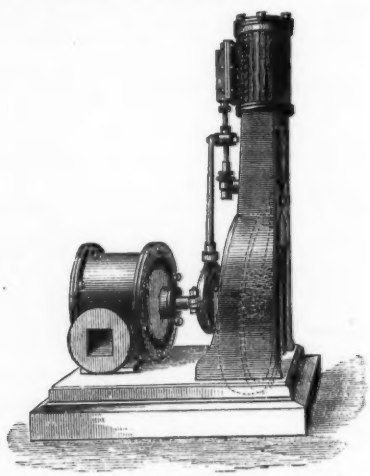

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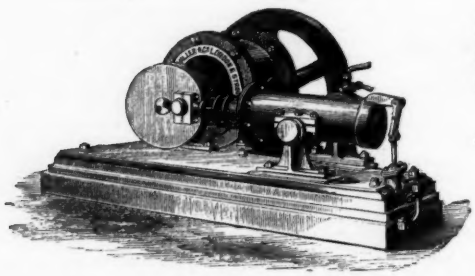

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BYE-PASS VALVES.

Disc, Rack, and Screw Valves, Compensating Governors (For Steam Throttle Valves),

Tar, Liquor, and Water Pumps, Hydraulic Main Valves, Coke-Breaking Machines.

SEE PREVIOUS ADVERTISEMENTS. ILLUSTRATED CATALOGUE ON APPLICATION.

Phœnix Engineering Works, Park Street, Southwark, London, S.E.,

NEAR SOUTHWARK BRIDGE (FOUR MINUTES FROM HOLLAND STREET), AND AT

STROUD, GLOUCESTERSHIRE.

JAMES NEWTON & SONS,
(Established 1820)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES and FIRE-CLAY, and every Article suitable for
GAS AND WATER WORKS.

THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS,
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.
TAR, LIQUOR, AND SPENT OXIDE
Purchased for Cash against Delivery.

THE ONLY RELIABLE
DRY CENTRE-VALVE.
WORKING ONE, TWO, THREE, OR FOUR PURIFIERS ON AT THE TIME.
ALSO MADE FOR TWO OR THREE PURIFIERS.
No Springing. No Leakage. No Foul Gas passed in Changing. Special Facility for Blowing the Air out of the Fresh Box before putting in Action, without driving it forward into the Holders.
Write for Prospectus.
ALSO DOUBLE-ACTION DOUBLE-FACED GAS & WATER VALVES.
F. WECK, 86, NEW STREET, BIRMINGHAM.

FIRE-BRICKS. ✣
✣ FIRE-CLAY.
JAMES WHITE & CO.,
Albert Oil-Works,
WIDNES, LANCASHIRE.
Sole Proprietors of the Largest and Purest Beds of Fire-Clay in England.
FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the market.
GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest and Finest Quality.
ANALYSIS AND REFERENCES ON APPLICATION.

THE
"SILVER" LIGHT.

CHANDLER'S PATENT.
SUITABLE FOR EVERY FORM OF LIGHTING.
A beautiful white light from ordinary Gas. Silent, steady, and economical.
PACKED IN BOX 9s., SUBJECT.
S. CHANDLER & SONS,
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PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.
For particulars, price &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.
Prices are Reduced.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
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MIRFIELD, NORMANTON.

GAS AND WATER PIPES.
1¼ to 12 IN. BORE.

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MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
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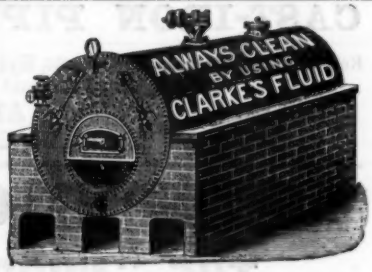
THE
LANEMARK COAL Co., LTD.,
Now offer their superior
GAS COALS
LANEMARK CANNEL.
Yield of Gas per ton . . 10,880 cub. ft.
Illuminating Power . . 29·21 candles.
Coke per ton . . . . 1266·96 lbs.
LANEMARK GAS COAL.
Yield of Gas per ton . . 11,879 cub. ft.
Illuminating Power . . 17·88 candles.
Coke per ton . . . . 1285·53 lbs.
LANEMARK GAS BRIQUETTES.
Yield of Gas per ton . . 10,734 cub. ft.
Illuminating Power . . 22·70 candles.
Coke per ton . . . . . 1320 lbs.
For Prices and Analyses, apply to
LANEMARK COAL Co., Ltd.,
NEW CUMNOCK, N.B.

TROTTER, HAINES, & CORBETT,
BRETTELLS' ESTATE
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK,
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAYS.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

GAS COAL.
POPE & PEARSON, LTD.,
have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles; or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.
One ton yields 12½ cwt. of good coke.
This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.
For further particulars apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.



A 10-H.P. BOILER
KEPT PERFECTLY CLEAN FOR
ONE SHILLING PER WEEK
And much smaller Coal Bills. Softens the Hardest Water, and keeps Gauge-Glasses quite clear.
H. CLARKE & Co., Ld., Ipswich.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
CANNEL & COAL.

TYNE
BOGHEAD ✣
✣ CANNEL.
Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles
Coke per ton . . . . . 1,301·98 lbs.
EAST PONTOP ✣
✣ GAS COAL.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.
For Prices and complete Analysis, apply to
YOUNG, DANCE, & CO.,
COAL OWNERS, NEWCASTLE-ON-TYNE,
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ALFRETON IRON-WORKS, DERBYSHIRE,
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WENLOCK IRON WHARF, 21 & 22, WHARF ROAD,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers and rendering leakage impossible.

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FOR GAS, ETC., PREPARED BY
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VALUATION OF COAL
FOR GAS MAKING, ETC.
Estimation of (1) Moisture, 1s.; (2) Volatile Matter, 1s.; (3) Coke, 1s.; (4) Permanent Gases, 2s. 6d.; (5) Ash, 1s.; (6) Ammonia Capacity, 2s.; (7) Carbon, 1s. 6d.; (8) Sulphur, 2s. 6d. 1, 2, and 3 = 2s. 6d.; 1, 3, and 4 = 4s.
Complete Combustion, 10s. 6d.
Five Samples submitted at same time to secure above Rate.
Estimation of Ammoniacal Liquor, 2s. 6d.; Oxide, for Active Iron, 2s.; for Sulphur, 3s.
R. D. GIBBS, Ph. Ch., Summerfield Crescent, Birmingham.

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FOR GAS AND WATER.
VALVES
FOR GAS, WATER, AND STEAM.
TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

JOHN BROWN & CO., LIMITED,
ATLAS STEEL AND IRON WORKS, SHEFFIELD,
ALDWARKE MAIN GAS COAL.
This Coal yields 12,600 feet of 19-candle gas per ton.
Weight of illuminating matter in pounds of sperm, 820·80. Very free from impurities.

CAST-IRON PIPES, ETC.
THOMAS SPITTLE, LTD.
[ESTABLISHED OVER 50 YEARS.]
CAMBRIAN FOUNDRY, NEWPORT, MON.,
MAKERS OF
CAST-IRON PIPES FOR GAS, WATER, AND STEAM.
ALSO
Retorts, Mouthpieces, Lamp-Posts, Hydraulic Mains, H-Pipes, Dip-Pipes, Buckstaves, Ash-pans, Sight-Holes, Syphons, Ascension-Pipes, Fire Doors and Frames, Fire-Bars, Hydrants, Valves, Purifiers, Tanks, Columns, &c., &c.
ALSO ALL WROUGHT-IRON WORK.
THE LARGEST MAKERS IN WALES.

SPECIALITIES.
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"ROBUS" IMPROVED RETORT SETTINGS, with COKE, TAR, and BREEZE FURNACES.
THE ABOVE SETTINGS & FURNACES ARE PROVING EMINENTLY SATISFACTORY.
Every Particular, with Estimates, forwarded upon Application to
MESSRS. J. & H. ROBUS,
CONTRACTORS FOR THE ERECTION OF GAS & WATER WORKS,
37, WALBROOK, LONDON, E.C.

JOSEPH CLIFF AND SONS,
THE ORIGINAL (ESTABLISHED 1795). WORTLEY FIRE-BRICK WORKS,
NEAR LEEDS.
SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

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THREE MEDALS AND HONOURABLE MENTION
WERE AWARDED TO
JOSEPH CLIFF & SONS,
For their Various Exhibits, amongst which is a
SILVER MEDAL FOR THEIR PATENT MACHINE-MADE RETORTS AND FIRE-BRICKS,
Being the Highest Honour given for this Class.
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FACE YOUR RETORT MOUTHPIECES.

JOHN RUSCOE calls attention to his Retort Mouthpiece and Lid Facing Machines, which are in extensive use; also to his Lathes, Drilling, Slotting, Grooving, and Planing Machines, Smiths' Hearths, Smithy Fans, Roots' Blowers; also special Screwing Machines for Gas Tubes and Bolts, Taps, Wrenches, Pipe Cutters, special Taper and Twisted Rymers, Drills, &c.

PATENT TWISTED TAPS, DIES, & CUTTERS.

Thousands in constant work, give universal satisfaction.

Work Easier, Less Friction, Last Longer, and do Better Work than straight Grooves.

Main Drilling Stand, with Cup Drills, 1¼ to 6 inch; Taps, Rymers, and Drills.

Ratchet Screwing Stocks, and Adjustable Once-up Stocks, Dies, Guides, &c.

Inquiries and Trial Orders Solicited. Everything Guaranteed. Apply to

JOHN RUSCOE, Albion Works, Hyde, near Manchester.

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PATENT STREET LAMPS,

NO PUTTY OR OTHER MATERIALS ARE REQUIRED TO SECURE THE GLASS. PRICE 9s. 9d. EACH NET.

D. Hulett's Improved Service Cleanser, for the removal of Naphthalene and other obstructions in Service-Pipes, Price 70s. net.

IMPROVED HIGH-POWER LANTERNS; PRICES ON APPLICATION.

Patentees of Improved Wet and Dry Gas-Meters.

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SHOW-ROOM AND WORKS: **55 & 56, HIGH HOLBORN, LONDON.**

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MANUFACTURERS of GAS and CHEMICAL PLANT, **ELLAND, YORKS.**

VALVES OF ALL DESCRIPTIONS AND FOR ALL PURPOSES.

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EXHAUSTERS.

ALL VALVES TESTED TO 40lbs. AND FLANGES FACED.

Prompt delivery guaranteed.

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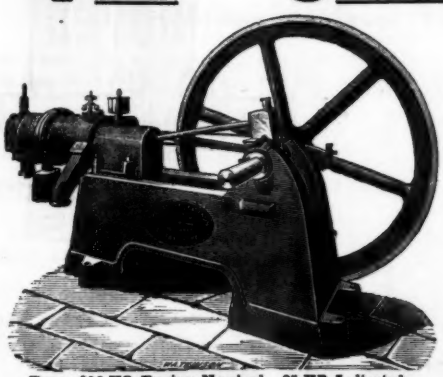
THE "CAMPBELL" GAS-ENGINE.



Type of 10-HP. Engine, Nominal. 25-HP. Indicated.

GREAT SUCCESS.

20 PER CENT. CHEAPER THAN ANY OTHER.

Gives the Highest Satisfaction with all kinds of Work.

Testimonial from Mr. JAMES MOON, Engineer to the Filey Gas-Works.

Feb. 9, 1889.

GENTLEMEN,—We have been using one of your Gas-Engines on our Works for about four months, and I have pleasure in saying that it does its work in a very satisfactory manner. The engine is half-horse power, steady in all its movements, and, with ordinary care, will drive the exhaust apparatus at an even gauge.—I remain, Yours respectfully,

(Signed) JAMES MOON.

For Price Lists and full particulars, apply to the Sole Makers:

THE CAMPBELL GAS-ENGINE CO., LIMITED,

WELL LANE, HALIFAX, YORKS.

HANNA, DONALD, & WILSON,

(ESTABLISHED 1851)

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FOR THE

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IMPROVED FIXED OR TRAVELLING HYDRAULIC PURIFIER-COVER LIFTERS,

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TAR AND LIQUOR PUMPS, HYDRAULIC SLUICE AND SLIDE VALVES, LAMP-POSTS AND HYDRANTS COMBINED.

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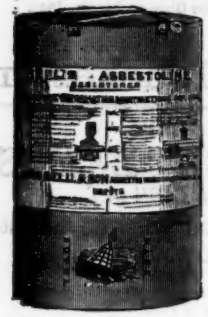
BELL'S ASBESTOLINE.

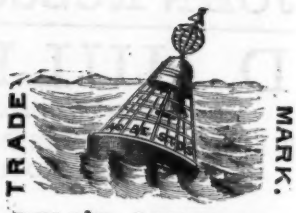
REGISTERED.



All kegs are labelled as above.

ADVANTAGES OF ASBESTOLINE.

ASBESTOLINE is the most efficient Lubricant for all bearings.
ASBESTOLINE is the cheapest Lubricant.
ASBESTOLINE saves from 50 to 90 per cent. of the Cost of Oil.
ASBESTOLINE is the Cheapest Lubricant.
ASBESTOLINE is favoured by Insurance Companies.
ASBESTOLINE is the most Inodorous Lubricant.
ASBESTOLINE is the safest Lubricant from Ignition.
ASBESTOLINE has beaten all other Lubricants in trials.
ASBESTOLINE is applicable in and out doors in every Climate.
ASBESTOLINE requires no special application.



CONSISTENCY OF ASBESTOLINE.

ASBESTOLINE, to meet all circumstances, is made in four degrees of consistency—A, B, C, and CC.

ASBESTOLINE, A, is specially adapted to ordinary Land Engines and Machinery, in and out door, in this country.

ASBESTOLINE, B, a little more solid, is for use on Steamships in temperate climates, also on land when it is desirable to have Lubricant stiffer than A.

ASBESTOLINE, C, is for use in tropical climates, both ashore and afloat. It is also invaluable in works in this country when the temperature is high.

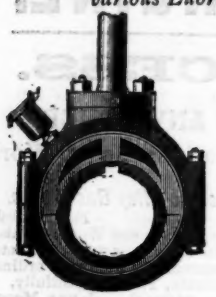
ASBESTOLINE, CC, is designed for use on Calenders, Paper-Machines, &c., where the bearings are heated by steam passing through, and sometimes is advantageously used instead of C.

The reputation of Asbestoline as a Lubricant of the highest efficiency in every kind of Machinery is established; and it has never been equalled by any other Lubricant in the numerous cases of special difficulty in which the best oils are ineffectual. It is used with marked success in Steel and Iron Works, Collieries, Cotton and Wool Mills, and other Textile Manufactories. In Corn-Mills it has proved invaluable on the roller and other modern machines. In Saw-Mills, on machines going up to 5000 revolutions per minute, its work has never been approached by any other Lubricant. On Electric Lighting Machinery, and in Steamships of all sizes throughout the world, the success of Asbestoline is unequalled. Many engines and machines of all descriptions give trouble, and show bad results both in working and wear, when the system of lubrication has not received due consideration. Engineering firms of the highest standing have given to it their powerful testimony and support.

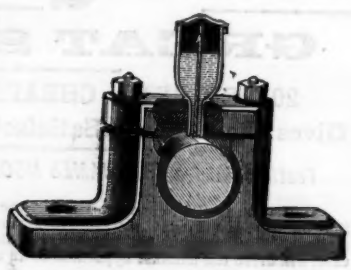
Supplied in Kegs, 28, 56, or 112 lb. Price, 2/3 per lb. Kegs Free. Special Terms for Large Quantities.

IMPORTANT TO EXPORT MERCHANTS.—*One pound of "Asbestoline" equals 2 gallons of Oil weighing 18lbs.; consequently the saving in freight is very considerable. Liberal Terms are conceded to Export Merchants.*

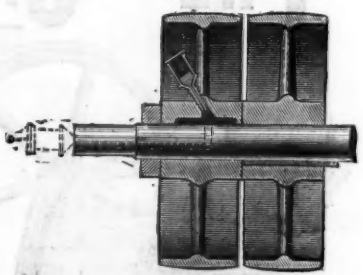
Below will be found illustrations of the mode of fixing Lubricators for Asbestoline to bearings. Full particulars of the various Lubricators supplied for Asbestoline, and the manner of fitting, in catalogue free on application.



Lubricator fitted to Eccentric of Vertical Engine



Showing Section of Lubricator fitted to ordinary Bearings.



Lubricator in different position for Loose Pulleys.

THE ATTENTION OF

ENGINEERS, AND ALL USERS OF STEAM POWER AND MACHINERY,

IS SPECIALLY INVITED TO THE FOLLOWING REPORT.

Owing to the number of Greases now offered, samples of BELL'S ASBESTOLINE were submitted to Otto Hehner, Esq., for analysis, and the subjoined Report fully proves BELL'S ASBESTOLINE to be the safest as well as the best Lubricant for all purposes:—

The Laboratory, 11, *Billiter Square, E.C., London, May* 3, 1888.

I have subjected a sample of Bell's Asbestoline taken from the stores of Messrs. J. Bell and Son, in Southwark Street, to a number of tests, in order to ascertain whether its use in Mills or Factories might contribute to the danger from Fire.

I found that Asbestoline **ignites only with the greatest difficulty** when brought into contact with flame; that wood and other combustible material soaked in Asbestoline burns, if anything, with greater difficulty than by itself; that its **flashing point** is so high that it lies **beyond the range of Mercurial Thermometers**; and that consequently no friction obtainable in the ordinary run of machinery is capable of developing inflammable vapours from it.

Bell's Asbestoline is **as absolutely safe a Lubricant as can be desired or obtainable.** In the case of fire breaking out from any cause, it does not assist the conflagration; and it is **quite incapable of leading to spontaneous combustion,** either by itself or in contact with inflammable material.

From the physical nature of Asbestoline its use is of necessity perfectly clean and free from waste.

(Signed) OTTO HEHNER, Public Analyst.

Illustrated Priced Catalogue, with numerous Testimonials by Leading Firms, free on application.

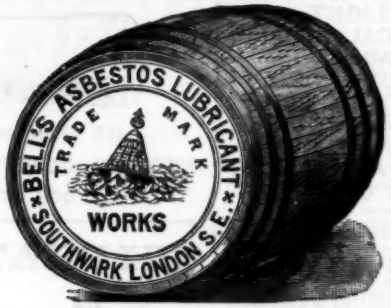
BELL'S ASBESTOS COMPANY, LIMITED,

DEPOTS—MANCHESTER: Victoria Buildings, Deansgate. **LIVERPOOL:** 2, Strand Street, James Street.

BELL'S ASBESTOS LUBRICANT.

(REGISTERED.)

All Drums marked as above.



Every Cask is sent out as above.

All Corks are sealed as above.

Any Customer receiving Oil sold as **Bell's Asbestos Lubricant**, and Cask, Drum or Corks not marked as above, is earnestly requested to forward us sample and particulars of where obtained.

The following Oils, refined and prepared by our Asbestos process, are specially recommended to Users of Machinery of every kind in all parts of the world. We guarantee the quality of each to be unequalled at the price for the purpose named, and a Sample Drum, containing 5 gallons of each or any sort, will be sent on approval to any respectable firm in any part of the world :—

BELL'S SPECIAL GAS-ENGINE OIL.—This oil is guaranteed to stand flame temperature, and is suitable for light Machinery and Shafting where gas power is used.
Price **2s. 9d.** per gallon.

1a.—**BELL'S SPECIALLY PURIFIED DARK CYLINDER AND VALVE OIL.**—This oil is guaranteed not to gum, corrode, or in any way injure metal surfaces. It will not carbonize, nor leave any deposit whatever in cylinders or condensers, nor will it injure india-rubber valves. It is absolutely pure hydrocarbon, and will work admirably in all good Sight-feed Lubricators.
Price **3s. 9d.** per gallon.

2a.—Bell's Specially Refined and Purified Pale Cylinder and Valve Oil contains the same properties as 1a, and is one of the very best Oils of the Valvoline class in the market.
Price **4s. 6d.** per gallon.

BELL'S PALE COMPOUND MACHINERY AND ENGINE OIL FOR EXTERNAL LUBRICATION ONLY.

"3c."—For small and medium-sized Engines, Shafting, and quick-running Machinery, displacing Lard Oil. Price **2s. 6d.** per gallon.

"3c. Special."—Heavier bodied than "3c.," and suitable for Locos. and Stationary Engines up to 300-H.P., displacing Olive Oil.
Price **2s. 9d.** per gallon.

"3c. Marine."—Much heavier than "3c.;" suitable for Marine Engines and heaviest Stationary Engines, Shafting, &c., displacing Castor Oil. Price **3s.** per gallon.

BELL'S AGRICULTURAL MACHINE OIL, for Traction Engines, Road Rollers, and all Machines working out of doors. This Oil will not set on bright parts, is not affected by extreme cold or the rays of the sun. Price **2s. 9d.** per gallon.

For other Qualities and Prices, with Testimonials, see Catalogue, free on application.

BELL'S ASBESTOS

EXPANSION SHEETING.

The above, which can only be obtained from this house, is recognized as the Most Efficient and Economical Jointing Material in use. It is composed of a specially prepared India-rubber Compound, protected by a covering of Vulcanized Asbestos Sheeting, as shown above, and as it is the only Jointing Material which adequately combines PERMANENT ELASTICITY WITH HEAT RESISTANCE, the advantage it possesses will at once be seen.

SECTION OF SHEETING.
PATENT No. 640, 1884.

BELL'S ASBESTOS.

EXPANSION RINGS.

The centre from which the requisite elasticity is obtained will adapt itself to uneven surfaces to which it may be applied, and allow expansion and contraction to be fully taken up. The covering, being of Asbestos Cloth, imparts a protection to the centre, and so prolongs its elasticity. For Manhole, Mudhole, Steam-Pipe, and Mash-Tun Door Joints it is unequalled; and if applied as directed, a ring can be used many times over.

Price **6s.** per lb. in Sheets. Rings made up to Template, **9s.** per lb.

Made from 1-Ply for Cylinder and Faced Joints to any thickness for Uneven Surfaces.

Illustrated Priced Catalogues, with numerous Testimonials from Leading Firms, free on application.

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"THE METEOR."

NEW HIGH-POWER GAS-LAMP, WESTPHAL'S PATENT.
MOST INTENSE WHITE BRILLIANT GAS LIGHT.
MOST ECONOMICAL, SIMPLE, AND DURABLE.
DOES NOT GET OUT OF ORDER.
RIVALS THE ELECTRIC LIGHT.
NO ALTERATION REQUIRED TO EXISTING FITTINGS.
BURNER, BEING A CIRCULAR SLIT, DOES NOT CHOKE UP.

PARTICULARS & PRICES POST FREE.

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SOLE CONSIGNEES FOR GT. BRITAIN & COLONIES,
153 TO 155, CANNON STREET,
LONDON BRIDGE, E.C.

WILLIAM INGHAM & SONS,

WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing Adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

F. & C. OSLER,
(ESTABLISHED 1807)

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES,
TABLE GLASS OF ALL KINDS,
CHANDELIERS IN BRONZE AND ORMOLU.
MODERATOR LAMPS.

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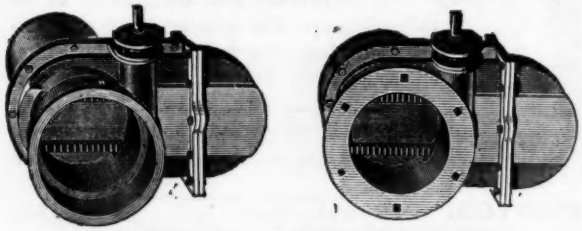
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.

R. & J. DEMPSTER'S



TESTED GAS-VALVES.

The pinions of all our Slide Valves are now cut by special machinery from solid forgings. Valves of 10-in. bore and upwards are fitted with double racks, without extra charge. The flanges are all faced and made to standard dimensions, unless otherwise ordered. All valves are tested and guaranteed tight before leaving the works.

Upwards of 200 Valves kept in stock to facilitate quick delivery.

Prices and Dimension Lists sent on application.

All kinds of Faced and Hydraulic Centre and other Valves made to order.

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MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
RETORTS CAREFULLY PACKED FOR SHIPMENT.
A STOCK OF DIFFERENT SHAPES ON HAND.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

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The most successful and approved Apparatus known up to the present time.

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GODDARD, MASSEY, & WARNER, ENGINEERS,
NOTTINGHAM,
OR TO
MAURICE SCHWAB,
96, DEANSGATE, MANCHESTER.

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GAS AND WATER PIPES
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CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

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THE "LUCIENT" HIGH-POWER & DURABLE GAS-LAMP.

ALEXANDER BROWN'S PATENT.

Gives the most intense, brilliant, and steady white light yet produced from gas. A light of over 270 candles for 13 cubic feet per hour. Such results are unapproached by any other Regenerative Gas-Lamp. To be seen in operation, and full particulars obtained of

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UPPER GROUND STREET, LONDON, S.E.,

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SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of **LYON'S 'PATENT' GAS MAIN SYPHONS.**

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ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

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ESTABLISHED A QUARTER OF A CENTURY. LIMITED.

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GAS PLANT

OF EVERY DESCRIPTION.

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GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

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HORSELEY COMPANY, LTD.

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GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS,

AND ALL KINDS OF GAS AND WATER WORKS PLANT.

S. PONTIFEX & CO.,

GAS and WATER ENGINEERS,

Manufacturers of and Contractors for the Maintenance of

PUBLIC LAMPS & LANTERNS:

GLASS—Flint, Opal, and Bent in Stock, and Cut to Sizes.

WELL LAMPS, STREET NAME TABLETS,

LAMP COLUMNS, HEAD IRONS, PUTTYLESS LAMPS,

LANTERN COCKS, REGULATORS,

Improved High-Power Lanterns for Lighting Street Refuges and Open Spaces.

BROWN'S PATENT

LAMPLIGHTERS' TORCHES.

PROPRIETORS AND MANUFACTURERS OF

BOX'S PATENT

PUTTYLESS STREET LAMP.

This Lamp may be supplied fitted with clear opal, or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing Lamps to this system can be supplied at moderate prices.

S. PONTIFEX & CO., 22, COLEMAN ST., LONDON.

Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

WILLEY AND CO.,

GAS ENGINEERING WORKS,

COMMERCIAL ROAD, EXETER.

London Offices: 6 & 7, KING WILLIAM STREET, E.C.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single-Lift, any size. Some of the largest in the Kingdom erected by this Firm are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **Mr. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

W. PARKINSON & CO.'S
PRESSURE RAISERS

Have been supplied for many years, and are now in successful operation, for the purpose of

INCREASING THE PRESSURE IN LOW DISTRICTS, ETC.

The Machine acts as an Exhauster, drawing the Gas from the Main and propelling it according to the Pressure required. The result is obtained by a Wet-Meter Drum, which is revolved by Multiplying Wheels and Pullies, actuated by a Weight, as shown in the Engraving. The Pullies may be so arranged as to keep the Apparatus at Work for many hours, provided only there is sufficient depth for the Weight to fall. Pressure Raisers have been successfully employed in connection with Apparatus for the Manufacture of Oil Gas, &c. They are also used for supplying a current of Air for various purposes.

TESTIMONIALS.

From Peter W. Barlow, Esq., F.R.S., F.G.S.
Engineer to the Tower Subway Co.

56, Landsdowne Road, W.,
Feb. 21, 1883.

Dear Sirs,

The Gas-Pressure Engine in the Tower Subway acts most satisfactorily. It requires very little attention, and is very rarely out of order.

I am, yours truly,
Peter W. Barlow.

Cork Gas Consumers' Company,
Gas-Works, Cork,
20th Feb., 1883.

Gentlemen,

In reply to yours, I beg to say that the Motive-Power Meters with which you have supplied this Company are doing very well. With them we are able to give a good supply to consumers in districts where it would be otherwise difficult to do so.

I am, faithfully yours,
Thomas Travers,
Engineer.

COTTAGE LANE WORKS, CITY ROAD, LONDON, E.C.

Telegraphic Address: "INDEX, LONDON."

[See also Advt., p. 940.

London: Printed by Walter King (at the office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London,—Tuesday, May 21, 1889.